

Appendix J

Approved Work Plans

**CONTRACTOR QUALITY CONTROL PLAN
REMEDIAL CONSTRUCTION ACTIVITIES
OLD ROOSEVELT FIELD CONTAMINATED GROUNDWATER AREA
SUPERFUND SITE
GARDEN CITY, NEW YORK**

SUBCONTRACT NO. 3320-023-001-CN-S

Submitted to:

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List of Acronyms

ASTM	American Society for Testing and Materials
CAR	Corrective Action Requests
CDFR	Chemical Data Final Report
CDM	CDM Federal Programs Corporation
COC	chain-of-custody
CQCP	Contractor Quality Control Plan
DCA	1,2-dichloroethane
DCE	cis-1,2-dichloroethene
DOE	U.S. Department of Energy
DFW	Definable Feature of Work
DQCR	Daily Quality Control Report
DRCR	Document Review Comment Record
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
FAR	Federal Acquisition Regulation
FSP	Field Sampling Plan
FWV	Field Work Variance
GWTF	Groundwater Treatment Facility
ISO	International Standards Organization
ITP	Initial Testing Program
MSDS	Material Safety Data Sheet
M&TE	measurement and test equipment
MTBE	Methyl tert-butyl ether
NCR	Nonconformance Report
NELAP	National Environmental Laboratory and Accreditation Program
NIST	National Institute of Standards and Techniques
O&M	Operations and Maintenance
PCE	Tetrachloroethene
PM	Project Manager
PO	Purchase Order
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCM	Quality Control Manager
QCT	Quality Control Team
RFP	Request for Proposal
ROD	Record of Decision
SHSO	Site Health and Safety Officer
SOP	Standard Operating Procedure
SOW	Statement of Work
SSHP	Site Safety and Health Plan
SWO	Stop Work Order
TCE	Trichloroethene

List of Acronyms (Continued)

USACE U.S. Army Corps of Engineers
~~VOC~~ ~~Volatile Organic Compound~~

Terms and Definitions

Acceptance Criteria - Specified performance limits placed on characteristics of an item, process, or service defined in codes, standards, or other requirement documents.

Activities that Affect Quality - Activities that, if not performed properly, could compromise the validity of information or data reported, which could result in an unacceptable risk to the environment, health, or safety of the public or the workers involved, or could have a detrimental effect on the achievement of the project objectives.

Assessment - An inclusive term meaning any of the following: audit, performance evaluation, management systems review, peer review, or surveillance performed by or for management.

Audit - A formal, planned and documented activity performed to determine, by investigation, examination, or evaluation of objective evidence, the compliance with established plans, procedures, instructions, drawings, and other applicable documents, and the effectiveness of implementation. An audit should not be confused with surveillance or inspection activities performed for the sole purpose of process control or product acceptance.

Consequences of Nonconformance - Failure to comply with the acceptability criteria will result in the issuance of a Nonconformance Report. Nonconformance Reports will identify the nonconforming product or service, cause of the nonconformance, acceptability criteria not met, recommended corrective action, and verification of corrective action.

Contractor Quality Control Plan (CQCP) - A technical document that describes the management system for planning, performing, assessing, and inspecting work to ensure that the results demonstrate stated acceptability criteria are met. The CQCP will describe the organizational structure, QC policies and procedures, functional responsibilities, levels of accountability and authority, and necessary interfaces for organizations performing activities in support of the subcontract projects.

Corrective Action - Measures taken to rectify deviant conditions and, where necessary, to preclude repetition.

Deficiency - The failure or inability to meet the prescribed quality standards or procedures set forth for the project or site-specific activity.

Deliverable - A document, report, study, information, sample or other item required by the subcontract scope of work or specification to be submitted to the client. Deliverables are usually listed on a Submittal Register.

Document - Any written or pictorial information describing; defining; specifying; reporting; or certifying activities, requirements, procedures, or results.

Field Work Variance - An identified deviation from approved plans, procedures or specified requirements.

Field Work Variance Approval - Documented authorization from the Contracting Officer or Contracting Officer's representative to depart from approved plans, procedures or specified requirements.

Finding - An identified noncompliance or deviation from established requirements.

Independent (Personnel) - An individual or group of individuals qualified to analyze, review, inspect, test, audit, or otherwise evaluate data and work results because:

- a. They had no direct responsibility for, or involvement in, performing the activity or work
- b. They are not accountable for the activity or work result
- c. They do not report directly to supervisors who are responsible for performing the activity or work to be evaluated.
- d. They have appropriate technical capabilities to understand applicable procedures.

Inspection - Examination or measurement to verify whether an item or activity conforms to specific requirements.

Inspector - A qualified person who performs inspection activities to verify conformance to specific requirements.

Item - An all-inclusive term used in place of any of the following: object, facility, sample, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, system, unit, documented concepts, or data.

Nonconformance - A deficiency in implementation of a procedure or standard which renders the quality of an item unacceptable or indeterminate with respect to acceptability criteria. Examples of nonconformance's include, but are not limited to test failures, physical defects, incorrect or inadequate documentation, data losses, or deviation from prescribed processing, inspection, or procedure.

Objective Evidence - Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity that is based on observations, measurements, or tests that can be verified.

Observation - A statement of fact regarding the potential for a noncompliance which could lead to a more serious problem if not identified and/or corrected, but which does not constitute a lack of compliance with established requirements.

Procedure - A document that specifies or describes how an activity is to be performed.

Preparatory Inspection - A systematic, documented review of the readiness for startup or continued extended use of a facility, process, or activity. Preparatory inspections are typically conducted before proceeding beyond project milestones and prior to institution of a major phase of work activities.

Products and Services Acceptability Criteria - The standards by which products and services will be compared or judged to determine acceptance or compliance. Acceptability criteria will be based on the Subcontract Scope of Work, applicable specifications and drawings, applicable Engineering Manuals, Rules and Regulations, industry standards, standard codes of practice, and other applicable rules and regulations.

Project Manager - The Arrowhead organizational manager having direct responsibility for administration and direction of the subcontract.

Qualification (Personnel) - The characteristics or abilities gained through education, training, and/or experience, as measured against established requirements, such as standards, tests and/or evaluation that relate to the ability of a person to perform a required function.

Quality - The degree to which an item or process meets or exceeds the user's requirements.

Quality Assurance (QA) - The planned and systematic actions necessary to provide confidence that a structure, system, service, or component will perform satisfactorily. When the product is a report of a significant study or investigation, QA also comprises those planned and systematic actions necessary to provide adequate confidence in the validity and integrity of the reported data, methods, and procedures and in the protection, retrievability, and replicability of the data. The quality management system includes a multidisciplinary system of management controls backed by quality verification and overview activities that demonstrate completeness and appropriateness of achieved quality.

Quality Control (QC) - A systematic process consisting of criteria for development and a series of checks and reviews during development to ensure conformance with the Standards of Quality Products and Services. The process that verifies the attributes of a material, sample, process, component, system, or facility in accordance with prescribed quality or acceptability criteria.

Quality Control Documents - Those documents that establish the Arrowhead requirements and methods to implement the client's activities. These documents are identified as the Work Plan, Sampling, Analysis, and Monitoring Plan, Contractor Quality Control Plan, Standard Quality Procedures, Standard Operating Procedures, Field Work Variances, and objective evidence of implementation.

Quality Control Program - The overall program established by an organization to implement the requirements of the subcontract document. The program assigns responsibilities and authorities, defines policies and requirements, and provides for the performance and assessment of work. The Quality Control program is described in the CQCP.

Quality Control Record - A completed document that furnishes evidence of the quality of items and/or activities affecting quality.

Quality Control Team - A team of QC personnel responsible for ensuring that products and services meet the requirements of the Subcontract Scope of Work, acceptability criteria, policies, and applicable regulations.

Quality Products and Services - A product or service that conforms to the customers' requirements (functional, technical, aesthetic, environmental) and expectations, and is consistent with the appropriate technical criteria.

Receiving - Taking delivery of an item at a designated location. Receiving does not constitute "acceptance" of the item.

Repair - The process of restoring a nonconforming characteristic to a condition such that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirement.

Rework - The process by which an item is made to conform to original requirements by completion or correction.

Sampling and Analysis Plan - Document consisting of a Field Sampling Plan and Quality Assurance Project Plan written for a site-specific purpose to provide requirements for the collection and analysis of environmental samples.

Senior Management - The top Program/PM for each organizational unit.

Significant Condition Adverse to Quality - A condition that, if left uncorrected, could have a serious effect on safety, operability or project completion. This term includes environmental and programs compliance.

Significant Rework - A condition requiring removal or rip out and replacement of defective work or materials as a result of not meeting the project requirements or quality standards.

Standard Operating Procedure (SOP) - An approved document that details an operation, responsibilities, analysis, process, or action whose mechanisms are thoroughly prescribed and that is commonly accepted as the method for performing certain routine or repetitive tasks.

Standard Quality Procedure (SQP) - A set of implementing procedures which establish the responsibilities and describe the methods of performing quality-affecting activities in response to the CQCP requirements.

Stop Work Order (SWO) - The order issued to Arrowhead management, Arrowhead Subcontractor or Arrowhead Supplier to stop further processing, delivery, installation, or operation until corrective action of a nonconformance, deficiency, or unsatisfactory condition has occurred.

Supplier - Individual or organization that furnishes items or services in accordance with a procurement document. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, consultant, and their subtier levels.

Surveillance - The act of monitoring or observing to verify whether an item or activity conforms to specified requirements.

Training - To impart specific information with regard to job functions, which will achieve initial proficiency, maintain proficiency and adapt to changes in technology, methods or job functions.

Use-As-Is - An approved disposition permitted for a nonconforming item when it has been established that the item is satisfactory for its intended use.

1.0 Introduction

This document presents the Contractor Quality Control Plan (CQCP) for construction and operation and maintenance services associated with construction of a Groundwater Treatment Facility at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site located in Garden City, New York. The document has been prepared for CDM Federal Programs Corporation (CDM) under the Subcontract #3320-023-001-CN-S. This document has been prepared to describe the quality control (QC) system and procedures that will be implemented by Arrowhead Contracting, Inc. (Arrowhead) and its subcontractors to ensure that activities performed during the course of the subcontract will be of the quality necessary to meet project objectives and specifications.

This CQCP has been developed utilizing selected concepts from the best or accepted industry quality management practices and requirements from applicable national and international standards. These practices and requirements are based upon such documents as U.S Army Corps of Engineers, *Engineering and Design, Quality Management* (USACE, 1993); U.S. Environmental Protection Agency (EPA) Manual for Environmental Programs (EPA, 2000), *EPA Quality Manual for Environmental Programs* (1998a); U.S. Department of Energy Order 5700.6c, *Quality Assurance* (DOE, 1991); *EPA Requirements for Quality Management Plans, QA/R-2* (EPA, 2001); and International Standards Organization 9004 *Quality Management and Quality System Elements Guidelines* (ISO, 1994). These standards reflect the latest operational, technological, and engineering practices, thereby providing a sound QC systems approach to the project. This CQCP also incorporates the QC requirements as outlined in Section 01451 (Subcontractor Quality Control) of the subcontract specifications. Furthermore, please refer to the site specific Quality Assurance Project Plan (QAPP) for an in-depth discussion of chemical and laboratory quality assurance/quality control.

1.1 Overview

Arrowhead Contracting is firmly committed to producing an end product that meets the technical and quality requirements of the subcontract. This CQCP presents the details of Arrowhead's system for providing control of project activities affecting quality. The QC system consists of the following general elements:

- Roles, responsibilities, and authorities of personnel

- Areas of applicability
- Criteria and guidelines
- Policies and procedures
- Tools to assure and increase quality in project planning and implementation
- Documentation requirements
- Independent technical and quality reviews.

This CQCP is designed as a management tool, providing end-users with specific measures for determining whether the QC system is being implemented in an effective manner. Accordingly, this CQCP establishes procedures, protocols, and instructions for the management and control of items or activities affecting project quality and for verifying and documenting compliance with subcontract requirements. The QC measures addressed herein include:

- QC organization and responsibilities
- Personnel qualifications and training
- QC reporting
- Document and records control
- Procurement control
- Testing and measurement control
- Inspections
- Non-conformance control and corrective actions
- Change control
- Subcontractor control
- Material receipt and inspections

The remainder of this plan addresses each of these QC measures in detail.

This CQCP has been designed to focus on the processes used to plan, implement, and document compliance with the quality criteria and standards of this project. Documentation of the QC process will be provided through the use of standardized forms, logs and checklists, which are provided in the Appendices A through N. This type of documentation is a key tool for tracking QC performance and for determining whether an activity is in control or whether a non-conforming situation exists. If non-conformances are identified, through documentation or other means, appropriate corrective actions will be implemented.

1.2 Scope of Work

The project is located at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site in Garden City, New York. The site is currently occupied by an office park and a large

retail shopping mall. Groundwater at the site is contaminated with volatile organic compounds (VOCs), particularly chlorinated VOCs such as tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), dichlorodifluoromethane and 1,2-dichloroethane (1,2-DCA), and non-chlorinated VOCs such as methyl tert-butyl ether (MTBE). The remedy, as defined in the September 2007 Record of Decision (ROD), involves groundwater extraction and ex-situ treatment (pump and treat) in order to expedite the restoration of water quality in the aquifer in comparison with natural processes alone, and provide for vapor intrusion mitigation, if deemed necessary.

The objective of the remedial action is to achieve the goals of the ROD, as shown on the Contract Drawings and Specifications.

Arrowhead has been contracted to complete the following Statement of Work (SOW).

- Clearing and grubbing
- Yard piping trenching and installation
- Groundwater treatment building construction
- Groundwater treatment system equipment installation
- Rough-in of electrical boxes and wiring methods
- Lighting fixtures, receptacles, and accessories
- Panelboards, circuit breakers, and motors control centers
- Power Supply
- Water supply piping, fittings, and supports
- Start-up and performance testing
- Concrete reinforcement and formwork
- Concrete mixing, placement, curing, and finishing
- Chemical Data Acquisition
- Operation and maintenance

In addition, the following sampling will be completed. Details of the sampling requirements can be found in the QAPP.

- Soil sampling associated with disposal of excess excavated soil and imported borrow material (QAPP Worksheet #17a)
- Sampling and analysis of groundwater influent and effluent and off-gas from the air stripper during the Initial Testing Program (ITP) (QAPP Worksheet #17b)
- Sampling and analysis of groundwater influent and effluent and off-gas from the air stripper during operation and maintenance (O&M) of groundwater treatment facility (GWTF) (QAPP Worksheet #17c)

1.3 Submittals

A wide variety of documents used to verify compliance with the project specifications, report test data, and provide documentation of project progress will be transmitted during the project. In total, there are approximately 120 individual submittals, most with multiple line items. In general the submittals will cover the following topics.

- Preconstruction Submittals
- Shop Drawings
- Samples
- Design Data
- Test Reports
- Certificates
- Manufacturers Instructions
- Manufacturers Field Reports
- O&M Data
- Closeout Submittals

A reference copy of the project transmittal register is included as Appendix O

2.0 Organization and Responsibilities

The Arrowhead Quality Control Team (QCT) is responsible for identifying, reporting, and documenting activities affecting quality, as well as verifying the correction of products and activities that do not conform to the specified quality requirements. The QCT maintains a close working relationship with CDM management, keeping them advised of situations, which, if not corrected or controlled, may adversely affect the overall quality of a project. A brief description of QC personnel responsibilities is provided in the following subparagraphs.

Table 2-1 presents a list of Arrowhead personnel with specific QC responsibilities. The overall project organization, including the positions discussed in this section, is depicted in Figure 2-1. Descriptions of the positions associated with health and safety are discussed in Section 2.0 of the Site Safety and Health Plan.

2.1 Project Manager

The Project Manager (PM) is responsible for the development and implementation of this plan. The PM will provide the overall direction of the program QC function. In addition, the PM will, as necessary, perform inspections (formally and informally), document reviews, and other quality functions as required to determine the continued effectiveness of this document. The PM will interface with CDM on the quality functions of the project. The PM will conduct self-assessment audits on Arrowhead and subcontractors for compliance with this document and subcontract specifications. The PM will also review project deliverables. Other responsibilities of the PM will include but will not be limited to:

- Preparing documents and determining the applicable quality requirements (w/ concurrence of the Corporate Quality Control Manager (QCM))
- Assigning the QC staff
- Reviewing project plans and procedures for quality issues
- Identifying the need for corrective actions and initiating, recommending, and coordinating solutions for project quality issues
- Concurring with disposition of non-conformances and verifying closure
- Reviewing procurement documents to ensure applicable quality requirements are adequately stipulated
- Serving as the Arrowhead coordinator for audits performed by external organizations, as applicable

2.2 Corporate Quality Control Manager

The Corporate Quality Control Manager (QCM) is responsible for the overall implementation of the QC program and reports to the President of Arrowhead. In the role, the Corporate QCM works with the PM to ensure that all project activities are implemented in accordance with all quality requirements, including this CQCP and the subcontract specifications. The Corporate QCM will have knowledge relevant to the requirements of the scope of work. The Corporate QCM has the authority to stop work that is not in compliance with the subcontract requirements and specifications. The Corporate QCM is responsible for assisting in the development and revision of this CQCP. Other duties of the Corporate QCM, as appropriate, include:

- Identifying the need for corrective action and initiating, recommending, and coordinating solutions for project quality problems with the appropriate project personnel
- Reviewing project plans and procedures to ensure that appropriate and relevant quality requirements have been included
- Approving project plans and procedures for quality issues
- Ensuring that project training requirements are satisfied
- Reporting regularly to project management on the status of QC implementation
- Disseminating applicable quality information to the project staff
- Concurring with disposition of project Nonconformance Reports (NCRs) and verifying closure
- Verifying quality requirements, which are stipulated in project procurement documents.

2.3 Project Quality Control Manager

The Project Quality Control Manager (QCM) is responsible for the implementation of the project specific QC program and reports to the Corporate QCM. In the role, the Project QCM works with the Corporate QCM, Site QCM, and PM to ensure that all project activities are implemented in accordance with all quality requirements, including this CQCP and the subcontract specifications. The Project QCM will have knowledge relevant to the requirements of the scope of work. Other duties of the Project QCM, as appropriate, include:

- Identifying the need for corrective action and initiating, recommending, and coordinating solutions for project quality problems with the appropriate project personnel
- Preparing QC checklists
- Reviewing project plans and procedures for quality issues
- Reviewing project plans and procedures to ensure that appropriate and relevant quality requirements have been included
- Ensuring that project training requirements are satisfied
- Reporting regularly to the Corporate QCM and project management on the status of QC implementation

- Disseminating applicable quality information to the project staff
- Concurring with disposition of project NCRs and verifying closure
- Preparing and/or approving Field Work Variances (FWVs)
- Verifying quality requirements, which are stipulated in project procurement documents.

2.4 Site Quality Control Manager

The Site QCM is responsible for field implementation of project QC in accordance with the requirements of this CQCP. The Site QCM, or an approved designee, will be onsite at all times during construction activities and will be responsible for the following:

- Conducting field QC inspection activities
- Reviewing and signing QC checklists
- Identifying and documenting non-conformances and ensuring closure of non-conformances
- Coordinating testing activities performed by subcontractors
- Completing Daily Quality Control Report (DQCR)
- Approving variances during field activities before work continues
- Approving, evaluating, and documenting the disposition of NCRs
- Overseeing and approving any required project training
- Providing indoctrination and training to subcontractor personnel performing quality related work
- Performing daily inspections (preparatory, initial, and follow-up) of definable features of work (DFWs) to ensure compliance with project acceptability criteria,
- Overseeing QC tests and inspections performed by subcontractors
- Working with the Project QCM to ensure that field activities meet applicable QC requirements as outlined in the CQCP.
- Assisting the Project QCM in preparation of documents for submittal to CDM.

During O&M activities the QCM will be onsite as necessary and will provide training and review site data as needed.

2.5 Site Supervisor

The Site Supervisor Operator is responsible for general site activities, coordination of subcontractors, tracking work completed, and insuring that work is being performed in accordance with the plans and specifications. The Site Supervisor is also responsible for the coordination and implementation of various field QC activities. The Site Supervisor will maintain communication with the Site QCM with respect to planned activities, non-conformances and corrective actions, subcontractor activities, and activity-specific QC requirements.

2.6 Subcontracts Manager

The Subcontracts Manager has overall responsibility for administration of subcontracts and purchase orders related to the procurement of services, supplies, materials and equipment for project execution. This individual will work with the PM, Project QCM, and Corporate QCM to ensure that appropriate QC requirements are integrated with the procurement documentation. The Subcontracts Manager will also administer the subcontract agreement between Arrowhead and CDM, including change orders and modifications. The Subcontracts Manager also has overall responsibility for project billing and accounts payable. This function reports to the PM.

2.7 Chemical Quality Control Officer

The Chemical Quality Control Officer is responsible for chemistry related quality objectives and is also a resource for chemistry and sampling issues. The Chemical Quality Control Officer ensures that chemistry related quality objectives are attained for the following:

- hazardous waste manifesting
- data quality objectives
- sampling and analysis
- data documentation and validation
- final project reports.

3.0 Personnel Training and Qualifications

Project activities will be performed by personnel qualified on the basis of education, experience, and training. Under the direction of the Site QCM, training will be provided to project personnel (including subcontractors) to communicate project QC requirements. This section discusses the methods for ensuring that project personnel are properly qualified and trained.

3.1 Project Staff Qualifications

Key management and technical staff qualifications will be evaluated by the PM to ensure that assigned personnel meet the minimum requirements as specified in the subcontract. The evaluation will occur prior to participating in project work activities. Arrowhead personnel assigned QC responsibilities (refer to Table 2-1) will be qualified on the basis of training, education, and/or experience. The qualifications of individuals will be documented by resumes, which include employment histories, professional registrations, and certifications (see Appendix B). Resumes of project staff and site personnel will be maintained in the record file system maintained in the Arrowhead Management Office.

3.2 Project-Specific Training

The PM and the Site QCM are responsible for ensuring that site personnel are properly instructed and trained in the implementation of project plans and procedures prior to their involvement in project activities. Individuals will not be permitted to work on activities, which for which they are not trained or qualified. Attendance at training sessions will be documented on a Training Attendance Record (Appendix C). Informal "on-the-job" training may be employed for training new employees and for training employees in new work activities. Experienced project staff and quality personnel will be available to supervise, counsel, and instruct less experienced staff. The project-specific training program will address:

- QC policies and procedures
- Scope of work, plans, and procedures
- Field documentation requirements
- Required field tests and measurements
- Applicable specifications and project requirements
- Organizational interfaces and responsibilities
- Non-conformance control and corrective action procedures

The training program will be structured to emphasize correct performance of work. Emphasis will be placed on ensuring adequate documentation of processes and activities.

3.3 *Equipment Training*

Personnel will receive "hands-on" training in the operation, maintenance, repair, and calibration of equipment, instruments, and tools prior to their utilization. The instructor (Site QCM, Site Supervisor, equipment manufacturer or supplier representative, or other trained/qualified personnel as appropriate) will review with trainees the operation procedures or operation and maintenance manuals of the equipment. The trainee will demonstrate for the instructor the proper operation and maintenance of equipment through utilization of that equipment. Documentation of equipment training will be recorded on a Training Attendance Record (Appendix C) or certificates provided by the manufacturer or the supplier.

4.0 Daily Quality Control Reports and Monthly Operations and Maintenance Reports

Arrowhead will prepare a Daily Quality Control Report (DQCR) (Appendix D) during the construction phase of the project. The report will be prepared by the Site QCM and will document work performed, material delivered, and any subcontractor activities at the site. The report will be submitted to CDM following review by the PM. The DQCR will include the following items:

- A brief summary of the work performed by Arrowhead and subcontractors
- Location(s) of work
- Summary of manpower (name, trade, and hours worked)
- List of materials received and consumed
- Inspection results, including copies of inspection checklists (refer to Section 10.0)
- Tests completed and results
- Location and description of non-conformances (as applicable)
- Corrective actions completed (as applicable)
- Instructions or work directives received from CDM
- Green remediation activities
- Other comments with respect to QC

During the O&M phase of the project, Arrowhead will prepare a Monthly Operations and Maintenance Report to document the O&M activities and relevant QC issues for each month. The monthly O&M report will be prepared by the Plant Operator and QCM and will document work performed, material delivered, and any subcontractor activities at the site. The report will be submitted to CDM following review by the PM. The monthly O&M report will include the following items:

- A brief summary of the work performed by Arrowhead and subcontractors
- Summary of plant operations, maintenance performed, and system operation status
- Summary of manpower (name, trade, and hours worked)
- List of materials received and consumed
- Inspection results, including copies of inspection checklists (refer to Section 10.0)
- Testing results, including laboratory analytical data
- Location and description of non-conformances (as applicable)
- Corrective actions completed (as applicable)
- Instructions or work directives received from CDM
- Calibration results for field testing instruments

- Other comments with respect to QC

Applicable test reports, inspection checklists, and other field submittals will be included as attachments to the report.

5.0 Document and Records Control

This section describes the methods and practices for the control of review, approval, distribution, storage, and maintenance of project-related documents (specifications, drawings, reports, plans, procedures, etc.) and records (instructions, correspondence, data, calculations, completed, checklists, certificates, etc.) including those provided to Arrowhead by subcontractors, vendors, and laboratories.

5.1 Document and Records Review

Prior to issuance or use, project documents and records (as appropriate) will be reviewed and approved. The review will cover administrative, technical, and quality issues as applicable to the document or record under consideration. The level of effort required for review will be commensurate with the complexity and scope of the document or record. For example, a project planning document will receive a higher level of review than a well completion diagram or inspection report. Nevertheless, all project documents and records will be reviewed and approved to the extent determined by the Corporate QCM or PM. Documents requiring formal approval will be denoted by a signature and date page, which will include reviewer signatures, including the Arrowhead PM and Corporate QCM. Both technical review and peer review, as necessary, will be performed to ensure that project documents are technically correct and meet the requirements of the subcontract. Technical reviews will be conducted on reports, plans, documents procuring technical services, and work instructions prior to being issued to CDM. Peer reviews will be based on the scope and needs of individual document.

5.1.1 Technical Review

A technical review is an in-depth analysis and evaluation of documents (primarily plans, procedures, reports, and instructions) for applicability, correctness, technical adequacy, completeness, appropriateness of interpretation, and assurance that subcontract requirements are satisfied. This type of review will be independently performed by qualified member(s) of the QCT, other than person(s) who prepared the original document. Independent reviewers may be selected from within Arrowhead or Arrowhead subcontractors, or they may be outside consultants retained in a review capacity. The review of plans, procedures, and reports is the responsibility of the PM or Corporate QCM. This PM or Corporate QCM will identify the documents to be reviewed, select qualified personnel to perform the reviews, participate in the review of documents, and verify that the review process is completed prior to document release.

Technical reviews will, as appropriate, focus on the following aspects of the document under consideration:

- Requirement Satisfaction - Is the objective of the report defined? Does the document satisfy the subcontract SOW, subcontract requirements, and pertinent regulatory requirements?
- Completeness - Does the document provide all necessary information? Does it include all figures, tables, appendices, and attachments required to completely document the information?
- Technical Correctness - Is the content of the document technically defensible? Are conclusions properly supported by correctly interpreted data? Are all figures, tables, and computations presented in the document correct?
- Executive Summary - Does it state the purpose of the document? Is it informative? Does it describe the SOW and summarize pertinent results and conclusions?
- Introduction - Does it clearly describe the problem(s) addressed by the document, state the objectives and scope of the document, and present pertinent background information?
- Methods - Were appropriate techniques used or recommended for the work? New, nonstandard methods should be described in the document text.
- Assumptions - Are assumptions clearly stated and justified?
- Text - Is it organized and presented in a logical sequence that contains the basic information, interpretation of that information, and results or conclusions of the interpretations?
- Appendices and Tables - Do they clearly present basic information? Appendices and tables should be interpreted and referred to in the text, but should be understandable without the text. Have they been prepared, checked, and approved?
- Conclusions or Results - Do they summarize the principal findings of the backup work? Do they answer each of the objectives described in the introduction? Are they technically defensible? No information should be given that was not discussed in the body of the document.
- References - Are all references cited in the text, tables, and figures included in a list of references? Are references cited correctly? Were pertinent references omitted in preparing the document?

5.1.2 Peer Review

Peer reviews are documented reviews performed by qualified personnel who are independent of the original work, but whom have the expertise to perform the work. Peer reviews are in-depth critical reviews and evaluations of documents, material, or data that require interpretation or judgment to verify or validate results or conclusions, or when conclusions, material, or data contained in the document go beyond reasonably available technology, or when technical criteria and requirements do not exist or are being developed. The PM or Corporate QCM will determine if a peer review will be required, the points in the work when the review will be performed, and the independent individual(s) who will perform the review. The need for peer review will be based on the level of technology required for the subcontract deliverable. Peer reviews will be performed after completion of internal document checks and prior to issuing the document to CDM.

Documents requiring peer review include:

- Work Plan
- Site Safety and Health Plan (SSHP)
- Contractor Quality Control Plan
- Environmental Protection Plan (EPP)
- Quality Assurance Project Plan
- Shop Drawings
- Engineering Calculations
- As-built Shop Drawings

5.1.3 External Review

The PM or Corporate QCM will respond to CDM comments (when provided) on all project submittals. CDM comments will be forwarded using a standard transmittal form (Appendix F), "CDM Federal Programs Corporation Submittal Review". As required, revised documents will be resubmitted to CDM after the comments are addressed or resolved. Section 5.5 provides further details with regard to submittal distribution.

5.2 Internal Review and Approval Process

When a document is ready for review, the PM or Corporate QCM will define the specific review process commensurate with the technical complexity/requirements of the document. The following procedure will be implemented for a document requiring a comprehensive review.

- The PM selects the appropriate technical/peer reviewers and schedules review times.
- The author completes the required portions of the Document Review Comment Record (DRCR) (Appendix F), and sends the appropriate DRCR and a copy of the document to each reviewer. The document copy should contain all texts, tables, figures, appendices, and attachments.
- Each reviewer examines the document and records any major comments or corrections on the DRCR. Recommended corrective actions will be indicated for each comment/correction. Minor comments/corrections (i.e., typos, grammatical errors, incomplete referencing, inconsistencies, drafting errors, and format errors) may be noted in red in the reviewer's document copy and need not be handled through the DRCR system.
- The reviewer and author discuss each DRCR comment/correction and document the agreed-upon dispositions on the DRCR. If agreement cannot be reached, the PM will make the final decision. If no action is to be taken on a particular comment/correction, adequate justification must be indicated.
- The author makes the agreed-upon revisions.
- The reviewer examines the document revisions. The reviewer and author then sign the DRCR for each satisfactorily completed comment/revision.
- When all comments/revisions have been closed, the author and reviewer then sign the "Closed" portion of the DRCR.
- If approval signatures are required on the document, each individual in the approval chain signs the approval page.
- The author submits the completed DRCR to project files along with the original copy of the document.

5.3 Controlled Documents

Controlled documents are documents, which have been assigned unique identifiers (i.e., copy or revision number) and are issued to a specific person, organization, or facility. These documents are maintained current by distributing revisions and addenda to holders on a controlled list. Controlled documents will be managed in a manner that will account for all copies of the document issued, and establish that the latest, approved versions of the documents have been distributed.

Documents requiring controlled distribution include those documents specifying quality requirements or prescribing activities affecting quality. In addition to this CQCP, controlled documents for the project include:

- Project Work Plan
- Site Safety and Health Plan (SSHP), incorporating an Environmental Monitoring Plan, and Site Security Plan
- Environmental Protection Plan (EPP), incorporating a Waste Management and Disposal Plan
- Treatment System Operations and Maintenance Plan

The control system will include a document control log and/or drawing log, which as a minimum includes the number and the title of the document, latest approved revision number, name of individual or organization the document was issued to, document control number, and status of superseded revisions. The Corporate QCM will be responsible for the control and issuance of controlled documents. The Corporate QCM or designee will ensure the following actions are taken with regard to controlled documents:

- Controlled documents and their distribution are identified
- Document and drawing control logs are prepared and updated
- Personnel responsible for the preparation, review, approval, and issuance of project documents and revisions are identified
- Instructions of how obsolete or superseded documents are removed or replaced by applicable revisions are included with the document distribution forms
- When draft documents are released prior to review and approval, they are identified and controlled as such.

5.4 Records

Quality records are those data, certificates, correspondence, etc. that provide direct documentary evidence of the quality of items, activities, services, compliance to the subcontract, or regulatory requirements, and which have been completed and submitted for acceptance and retention. Administrative records, such as general correspondence, do not directly provide documentary evidence of the quality of items or activities or compliance to the subcontract or regulatory requirements.

5.4.1 Indexing and Filing of Records

The indexing and filing of records will be performed by the Corporate QCM and maintained in a central filing system located at the Arrowhead project support office. Project record files will be

organized by project file categories in accordance with Arrowhead's standard master file index system. All of the categories may not be applicable to specific projects; consequently, categories will be added or deleted as appropriate to the project. Working documents maintained at the project site will not require filing until such time that they are no longer needed by field management personnel. The Corporate QCM is responsible for controlling and assembling project records and performing audits of the record files to verify continued effectiveness of the system.

5.4.2 Storage of Records

Records will be maintained and stored in a manner, which will preclude loss, damage, or any other detrimental conditions of the records. The filing system will provide for security from unauthorized entry to prevent loss of any records by theft or inadvertent mishandling. Only authorized personnel will be permitted to remove records from the filing area. A published list of authorized personnel will be available in the file area. A sign-out log will be used to keep track of files removed from the filing system. The borrower's name, the date the file was removed, the file title and category, and date returned will be recorded on the sign-out log.

5.5 Submittal Distribution

Project submittals to CDM, identified in the SOW, will be transmitted with the Transmittal Form provided in Appendix F, "Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance". The Site QCM and PM will prepare and the PM will transmit the subcontract deliverables identified in the project-specific Submittal Register, Eng Form 4288. Transmittal numbers will be issued by the PM, and the Submittal Register will be maintained and updated on a routine basis as submittals are approved by CDM. The PM will determine CDM requirements for the deliverable submittal, including the number of copies required and to whom the report copies should be transmitted. Documents will not be distributed to outside agencies or individuals without CDM approval.

The PM is responsible for the review and approval of "For Information Only" submittals. The submittals will be reviewed for conformance to specified requirements, completeness, and accuracy. Submittals requiring modifications or changes will be returned to the originator, subcontractor, or vendor for correction. The Project QCM will confirm compliance with all subcontract requirements by signing and dating the transmittal form in the signature block prior to submitting to CDM. Variations from the project requirements or specifications will be noted

and described in full on the Transmittal Form (Appendix F). CDM approval of such variations will be required.

Submittals that have been returned unapproved or returned with comments requiring resubmittal will be so noted on the Submittal Register and re-entered as a revision. The Project QCM will monitor the Submittal Register to verify submittals are being controlled, scheduled, and tracked in an effective manner. Submittals to Arrowhead from subcontractors or vendors will be reviewed and approved by the PM or Project QCM (refer to Sections 5.1 and 5.2) prior to transmitting the submittals to CDM.

Submittals with approval pending, or submittals that must be resubmitted for approval due to pending comments, will be processed in the same manner as the original submittal. Once revisions/corrections are incorporated, the revised submittal will be resubmitted and retransmitted using the Transmittal Form.

6.0 Procurement Control

This section describes the requirements for the preparation, review, and approval of procurement documents for products and services. Procurement of items, materials, and services will be performed in accordance with Arrowhead Procurement Procedures, Federal Acquisition Regulations (FARs), and the requirements of the subcontract agreement.

6.1 Procurement Document Technical Preparation

Under the direction of the PM, the procurement process is initiated by completing a Purchase Order (PO) (Appendix G). The person who prepares the PO is responsible for identifying applicable technical requirements. Large procurements, subcontracts, and certain equipment purchases may require the use of technical specialists or engineers to assist in preparation of the PO technical requirements. Procurement documents will state applicable requirements for technical performance, quality, acceptability, and documentation, as appropriate. Technical performance requirements may include:

- General requirements
 - Scope of work
 - Personnel qualifications and training
 - Licenses or permits
- Regulations and standards
- Acceptance Criteria (i.e., material composition, physical, and chemical requirements)
 - Type
 - Composition
 - Grade
 - Properties
 - Size/volume/quantity
 - Packaging
 - Handling
 - Shipping
 - Storage
- Delivery schedules
- Work procedures and certifications
- Performance and acceptance criteria
- Documentation indicating compliance with requirements (i.e., mill certificates, certificates of analyses, certified copies of performance tests, certificates of compliance, Operation and Maintenance Manuals, wiring diagrams, catalog cut sheets, etc.).

Technical requirements will either be directly included in the procurement documents or referenced to specific drawings, specifications, statements of work, procedures, or regulations (along with specific revision numbers and issue dates) that describe the items, materials, or services to be furnished.

6.2 Procurement Document Technical Review and Approval

Purchase orders and their attachments, including requests for proposals and quotes, will be reviewed by the PM or Corporate QCM. Attachments will be reviewed for the incorporation of appropriate quality requirements as listed in Section 6.1. Quality requirements will be based on approved project plans, specifications, drawings, and other applicable project requirements. The PM or Corporate QCM indicate concurrence with the PO and attachments by signing the PO. Changes or revisions resulting from the quality review will be incorporated into the PO by the originator. When approved, the PO is submitted to the procurement department under the direction of the Arrowhead Subcontracts Manager. The procurement department is responsible for issuing the POs to the selected supplier or subcontractor. For professional and construction services, the Subcontracts Manager will prepare a subcontract agreement for the selected firm. The subcontract agreement will incorporate the original PO and attachments. Revision(s) to procurement documents will be initiated using the same method as the original procurement, and will be accomplished taking into consideration any additional or modified design criteria, additional or modified technical performance requirements (refer to Section 6.1), or exceptions or changes requested by the supplier or subcontractor and the effect the changes will have on procurement.

6.3 Procurement Source Evaluation and Selection

Subcontractors and suppliers of quality related materials, including construction service subcontractors and laboratories, will be evaluated prior to use of their materials or services. Only pre-qualified subcontractors will be used. The evaluation will include the following, as appropriate:

- Historical Performance – The previous ability of a potential subcontractor to provide an item or service in a satisfactory manner will be evaluated. The experience of other purchases of similar items or services provided by the prospective subcontractor and any Arrowhead records of previous procurements can form the basis for the evaluation. The subcontractor's reputation and experience in the industry will also be considered.

- Subcontractor Records – A review of the subcontractor's current quality records will be evaluated.
- Prequalification Audit – The subcontractor's management capability, plant facilities, and technical or quality capabilities will be directly evaluated through a prequalification audit.

During the term of the purchase order and/or subcontract agreement, the quality of field activities affecting subcontractors or vendors will be monitored to verify the quality of the items and services being furnished. This will be accomplished through inspection and monitoring of field activities consistent with the extent of ongoing activities and the project schedule. Materials testing and analytical laboratories are required to meet the requirements of Section 7.0 of this plan prior to the start of activities or work on this project.

7.0 Testing Control

This section describes the required certifications and qualifications of testing and analytical services, primarily chemical analysis of compliance and performance monitoring samples.

7.1 Qualifications and Certifications of Testing Services

The following qualifications and certifications are applicable to the various testing services that will be used during the project:

- Analytical testing laboratories to be utilized will be accredited by the National Environmental Laboratory and Accreditation Program (NELAP) and the State of New York Department of Health.
- Materials testing (i.e. in-place density testing) will be conducted by an approved geotechnical testing firm licensed in the State of New York.

In addition, Arrowhead Contracting requires all subcontractors, including testing and analytical services, to be pre-qualified under Arrowhead procedures prior to award of a PO. This ensures the competence and qualifications of the laboratories to perform specific testing services.

Arrowhead QC procedures support the procurement process by incorporating laboratory inspections and audits (as necessary), evaluating supporting documentation, staff qualifications, equipment, and historical data. The Corporate QCM will verify that the required tests to be performed by the testing service are within the service's capabilities and that the procurement documents (refer to Section 6.0) correctly specify the test requirements, acceptance criteria, data, and reporting requirements. The testing service's capabilities will be reviewed with respect to accreditations, availability of instrumentation, compliance with calibration requirements, and suitability of environmental conditions, and other criteria as appropriate.

7.2 Specification of Testing Procedures

Tests will be performed in accordance with the subcontract specifications and approved planning documents that specify the requirements and criteria for preparation, performance, acceptance, and documentation of the testing activities. (For example, the QAPP contains specific QA procedures and requirements for analytical testing.) Testing procedures will incorporate the following elements, as applicable:

- Instructions and prerequisites to perform the test
- Referenced standards, procedures, specifications, or methods

- Use of test equipment
- Calibration requirements
- Hold or witness points
- Environmental conditions
- Test personnel qualifications and certifications
- Identification of required test data and reporting format
- Acceptance criteria.

7.3 Analytical Testing

The Corporate QCM is responsible for monitoring analytical laboratory activities to verify, as appropriate:

- Overall chemical quality control via compliance with the QAPP
- Laboratory sample preparation and testing procedures in accordance with the QAPP and referenced procedures
- Sample collection, identification, and handling in accordance with the Field Sampling Plan (FSP)
- Chain-of-custody (COC) documentation
- Data quality objectives, transfer, reduction, evaluation, and verification in accordance with the QAPP
- Test results, raw data, and validated data packages for compliance with analytical requirements and QAPP
- Required reports, including the Chemical Data Final Report (CDFR) and Data Validation Reports

7.4 Test Failures

Unacceptable test results will be brought to the immediate attention of the Corporate QCM for resolution prior to continuing with the activity. Test failures will result in the issuance of a Nonconformance Report (NCR) or a Corrective Action Request (CAR). Nonconformance Reports and CARs will be controlled, tracked, and closed out in accordance with the procedures described in Section 10.0.

7.5 Test Result Reporting and Documentation

The results of the geotechnical, material, and analytical tests will be documented using the laboratory approved test reports or data package requirements (as specified in the purchase order), as applicable. The test reports will include, as appropriate:

- Applicable subcontract requirements, test methods, and analytical procedures used
- Results of tests

- A statement certifying the tests conform to the established test method requirements
- Applicable raw data, supporting QC information, and electronic deliverables
- Signature of authorized representative of testing laboratory.

The Corporate QCM or PM will review the results for conformance to the testing procedures and acceptance criteria prior to submitting the results to CDM. The Corporate QCM will submit the test results in conjunction with the Monthly O&M Report (refer to Section 4.0).

8.0 Calibration and Maintenance of Measurement and Test Equipment

This section describes the responsibilities and methods for the control, calibration, and preventative maintenance of measurement and test equipment (M&TE) used in the field, including various meters, gauges, and monitoring devices. This section does not present information with regard to the calibration maintenance of testing equipment used by off-site laboratories or third-party testing services. These requirements are discussed in further detail in the QAPP.

8.1 Calibration Control

Field M&TE will be calibrated prior to being used for project activities and at prescribed intervals thereafter. During M&TE usage, operational checks of the equipment will be performed to verify the equipment's continued accuracy and operational function. Calibrations of M&TE will be performed by trained and qualified personnel, approved external agencies, or by the equipment manufacturer.

Calibration(s) will be performed in accordance with approved procedures or manufacturer's recommendations using appropriate standards, which have known valid relationships to nationally recognized standards (e.g., National Institute of Standards and Technology) or accepted values of natural physical or chemical constraints. If no national standard exists, the basis for calibration will be documented and approved by the PM and by the Corporate QCM. The following types of calibrations and checks will be performed as applicable for the specific instrument being used:

- Periodic Calibrations – Periodic calibrations are performed at prescribed intervals established for the M&TE to assure that the equipment is operating within its designed range and accuracy. These are usually performed by outside agencies or the M&TE manufacturer. A calibration certificate will be provided documenting the operational and functional acceptance of the M&TE.
- Specific Calibrations – Specific calibrations are performed for specific measurements or tests. These calibrations vary depending on the specific instrument and operating procedure. Specific calibrations are performed prior to the start of work and are reestablished at prescribed intervals that have been predetermined and are instrument and procedure specific.

- **Calibration Checks** – Calibration checks are performed to provide a quick, accurate, and consistent method of checking the specific calibration's correctness. This is accomplished by establishing a known acceptable/repeatable response during the specific calibration and periodically checking that response during the M&TE usage.

Calibration of M&TE will be performed in accordance with the procedures established by the instrument manufacturer or a nationally recognized authority (e.g., American Society for Testing and Materials (ASTM)), as applicable. The frequency calibrations will also be based these procedures. If periodic calibration is required, a label will be attached to M&TE indicating the date of current calibration, and due date of the next required calibration. Specific calibrations will be performed prior to each use. Once the M&TE calibration is completed, a reference value or response will be established and checked periodically during equipment usage to verify calibration accuracy (i.e., calibration check).

8.2 Equipment Identification

Measurement and test equipment will be uniquely identified by the manufacturer's serial number or other unique, assigned number. Whenever possible, the M&TE identification number will be permanently marked on the instrument. It will be located in a readily visible area that will not infringe on the equipment function or performance, preferably on the outside casing (i.e., top, bottom, or side). If permanent markings are not practical, an identification label will be affixed with the identification number clearly visible. This label will be replaced as needed to provide clear identification of the M&TE. A list of M&TE used on-site will be maintained by the Site QCM.

8.3 Reference Standards and Equipment

Calibration reference standards and equipment will have known relationships to the National Institute of Standards and Techniques (NIST) or other nationally recognized standards, consistent with the testing method. If a national standard does not exist, the basis for calibration will be fully documented and approved. Physical and chemical standards will have certifications traceable to NIST, EPA, or other recognized agencies. Standards that are repackaged or split will also have traceable lot or batch numbers transferred onto the new container.

8.4 Calibration Failure

Each individual user of M&TE is responsible for checking the calibration status of equipment to be used and confirming the acceptable calibration status prior to use. Equipment for which the

periodic calibration period has expired, equipment that fails calibration, or equipment that becomes inoperable during use will be removed from service and tagged as out-of-service. Out-of-service M&TE will be segregated from operational M&TE when practical. The specific reason for removal from service and the date of removal will also be stated on the out-of-service tag. The M&TE will then be repaired and/or recalibrated by the appropriate vendor or manufacturer as deemed appropriate. Measurement and test equipment that cannot be repaired will be replaced, as necessary, to provided support to the project.

Results of activities performed using equipment that has failed recalibration will be evaluated by the Site QCM and PM. If the activity results are adversely affected, the results of the evaluation will be documented as a nonconformance in accordance with Section 11.0.

8.5 Calibration Documentation

Specific calibration records will be prepared and documented for each M&TE used during the project. Calibration data will be documented on an Equipment Calibration Log (Appendix F) or a similar form. Calibration certificates are also an acceptable form of documentation. The PM or designee will be responsible for reviewing the calibration data for appropriateness, accuracy, readability, and completeness. Calibration documentation requirements for health and safety related M&TE are presented in the SSHP. Calibration documentation requirements for field sampling and screening M&TE are presented in the QAPP.

9.0 Inspections

This section provides the criteria for the performance of quality control inspections as part of the overall Contractor Quality Control Plan. Inspection of routine O&M procedures will be accomplished using checklists, which are discussed in the O&M Manual.

To facilitate the inspection process, individual DFWs are identified for significant item of work. Each DFW, in turn, will undergo a three-phase inspection process. Under this approach, the Site QCM, by examination or measurement, determines that a particular DFW complies with the specified quality requirements. The three-phase inspection system consists of preparatory, initial, and follow-up inspections for each DFW. The Site QCM will coordinate inspection activities with the PM, subcontractors, and field personnel. Inspection activities will be performed on a continuous basis for all on-going DFWs. The identified DFWs are:

- Clearing and grubbing
- Yard piping trenching and installation
- Site utility installation
- Stormwater basin rehabilitation
- Effluent outfall manhole termination
- Extraction wellhead construction
- Extraction well pump installation
- Treatment plant foundation construction
 - Footers
 - Foundation walls
 - Floor slab
 - Housekeeping pads
- Pre-engineered metal building erection
- Construction of interior walls and rooms (control room, bathroom, etc.)
- Groundwater treatment system equipment installation
- Installation of secondary electrical service
- Rough-in of electrical equipment
- Installation of electrical fixtures (lighting, receptacles, and accessories)
- Installation of electrical panel boards and motors control centers
- Installation of process control equipment
- Installation of potable water supply piping, fittings, and supports
- Site grading and restoration
- Asphalt roadway construction/repair
- System start-up and performance testing
- Chemical data acquisition
- Operation and maintenance

9.1 Definable Features of Work

A DFW is defined as a major work element that must be performed in order to execute and complete the routing operation or maintenance item. It consists of an activity or task that is separate and distinct from other activities and requires separate control. Refer to Table 9-1 for a DFW inspection log.

Example copies of inspection checklists that would be developed for a DFW are presented in Appendix J.

9.2 Preparatory Inspections

Preparatory inspections will be performed prior to the initiation of all DFWs. The preparatory inspection is performed in advance of any work being performed to determine whether preliminary activities have been completed to the extent that the DFW can proceed. This inspection will be conducted by the Site QCM and will be attended by field personnel and subcontractors. The preparatory inspection will be scheduled prior to the start of the DFW. All affected parties will be notified in advance of the inspection to coordinate their participation.

The preparatory inspection will include, but is not limited to:

- Review of pertinent subcontract requirements, plans, and specifications
- Review of required control inspections and test requirements
- Review of reports, forms, and checklists that need to be filled out during the activity
- Review of subcontracts and purchase orders
- Review of required licenses, permits, and certifications
- Establish that required planning documents have been reviewed and approved by the client
- Establish that the required materials and equipment for commencement of the DFW are on-hand, available, in working order, and are in accordance with plans and specifications
- Establish that the preliminary work required to begin the DFW is complete and conforms to approved plans
- Schedule the date that the initial inspection will be performed
- Review and discuss the health and safety requirements for the DFW

A preparatory inspection checklist is included in Appendix J.

For off-site testing laboratories, the Project QCM will conduct the preparatory inspection prior to the start of sampling activities. The preparatory inspection will be conducted by teleconferencing with the Laboratory QC Manager and/or Laboratory Project Manager. During the teleconference, pertinent QC requirements (as outlined in the QAPP) will be discussed with

the laboratory representatives, including sample turn-around-time, data quality requirements, and data reporting requirements.

9.3 Initial Inspections

Initial inspections will be conducted at the commencement of a DFW. The initial inspection will provide the opportunity for the Site QCM to observe the actual initiation of the work activity and the individual tasks associated with DFW. The inspection will be performed on a representative sample of work to evaluate the following criteria:

- Compliance with subcontract requirements, plans, and specifications
- Acceptable levels of workmanship
- Proper operation of equipment
- Identify use of defective or damaged materials
- Identify improper procedures or methods
- Acceptable test or inspection results
- Compliance with the health and safety requirements
- Completion or collection of pertinent records

An initial inspection checklist is included in Appendix J.

9.4 Follow-up Inspections

Follow-up QC inspections of field activities will be performed on a daily basis when work on a DFW is in progress. The follow-up inspections will be performed until the DFW is completed. The following items will be performed during the follow-up inspection:

- Verify compliance with subcontract requirements, plans, and specifications
- Verify proper operation of equipment
- Verify level of workmanship, if applicable
- Verify test or inspection results
- Verify that nonconformance issues are identified, corrected, and re-inspected
- Verify compliance with the health and safety requirements
- Verify completion or collection of pertinent records

A follow-up inspection checklist for the Old Roosevelt Field project is included in Appendix J.

Follow-up inspections will not apply to off-site testing laboratories. Subcontract laboratories will follow their approved QA Plan and applicable standard operating procedures. The usual processes followed for these instances will include teleconferencing with laboratory personnel on

a weekly basis and extensive review of the completed process (data packages) for elimination of any errors processed during the activity.

9.5 Final Inspections

Final inspections will be conducted in accordance with Section 01451 of the specifications. As appropriate, the results of Final Inspections will be documented on the Final Inspection Form provided in Appendix J. The four final inspections are:

- Punch-Out Inspection – conducted by the Contractors QC officer to develop and address a punch-list of items that need to be addressed.
- Pre-Final Inspection – The Engineer performs this inspection and develops a Pre-Final Punch List of items that need to be addressed. The Contractor will correct the items on the Pre-Final Punch List.
- Final Inspection – The final inspection is attended by representatives of the Engineer and Contractor plus additional federal, state, and local government personnel, as applicable.
- Post-Final Acceptance Inspection – Following the one-year operational and functional period, the post-final acceptance inspection will be held attended by representatives of the Engineer and Contractor plus additional federal, state, and local government personnel, as applicable.

9.6 Inspection Documentation

The preparatory, initial, and follow-up inspections will be documented on the checklists provided in Appendix J. The CDM construction supervisor will be notified prior to any inspections. These forms will be maintained at the treatment plant for review by CDM. If a final inspection for either a specific task or the entire project is required, this information will be provided on the Final Inspection Form (Appendix J). If the inspection process identifies a nonconforming condition, it will be documented, tracked, corrected, and closed-out in accordance with procedures detailed in Section 10.0. Refer to Table 9-2 for a summary of QC tests to be completed in addition to the DFW inspections.

10.0 Nonconformance and Corrective Actions

This section describes the responsibilities and methods to be used by project personnel to identify, control, and correct non-conformances. A nonconformance is defined as a deficiency or deviation in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate. Non-conformances can be associated with installed equipment, processes, items, materials, documentation, samples, analytical data and services that do not meet the subcontract specifications, plans, or other established requirements. Correction of non-conformances will be focused at determining the cause of the deficiency and instituting actions to correct the deficiency and prevent recurrence. Procedures for implementing changes to approved documents include Field Work Variances and Change Orders (refer to Section 12.0).

10.1 Nonconformance Identification

Non-conformances may be identified during field QC inspections, through informal surveillances of field activities, or at other times where field activities are being observed or evaluated. Arrowhead personnel or subcontractors who identify a nonconformance are responsible for immediately notifying the Site QCM or the PM. The Site QCM is then responsible for preparing a Nonconformance Report (NCR) (Appendix K) to describe and document the nonconformance. When immediate corrective action is required, that action will not be delayed for the processing of the NCR. The Site QCM, PM, and other project personnel will discuss the nonconformance to determine if it is properly described and that applicable project requirements have not been met to warrant issuance of the NCR.

10.2 Nonconformance Reports

Nonconformance Reports are used to document non-conformances found during QC inspections or other means. A NCR (Appendix K) will be generated upon encountering a nonconformance that cannot be immediately corrected or is of a repetitive nature. The NCR will include the following information:

- NCR identification number and date identified
- Responsible organization
- Detailed description of the nonconforming item or activity
- Cause of nonconformance

- Referenced criteria
- Recommended disposition/corrective action
- Disposition, verification, and date of corrective action

Nonconformance reports will be attached to the DQCR or Monthly O&M Report. Deficiencies, variations, test failures, and corrective actions proposed or taken as a result of the nonconformance will be documented in the DQCR or Monthly O&M Report.

Minor deficiencies or variations that do not warrant the preparation of a NCR or a FWV will be described and documented in the DQCR. The information provided will include the origin of the minor deficiency/variation (i.e. follow-up inspections), failed or out-of-control testing results (if applicable), corrective actions proposed or taken, a summary of instructions or communication with CDM regarding the deficiency/variation, and other information or proposed actions as appropriate.

10.3 Nonconformance Disposition

Non-conformances determined to be valid will be issued to the responsible organization (subcontractor, supplier, or vendor) for disposition. Dispositions to non-conformances will require the responsible organization to identify the cause, corrective action, action to preclude recurrence, and the date when all corrective actions will be completed. Corrective actions will be approved by the Corporate QCM and the PM prior to implementation. Nonconformance Reports will remain on open status until the corrective actions have been implemented and verified as acceptable by the Corporate QCM.

Corrective actions implemented in the field to correct non-conformances will be documented in the NCR and DQCR. Corrective actions implemented by laboratories or off-site vendors or suppliers will be documented in writing and submitted to Arrowhead for approval.

Documentation used to support the decision to closeout the NCR will be attached to the NCR and will be included with the DQCR. Nonconformance reports closed-out after the completion of the field activities will be submitted to CDM under separate cover.

10.4 Corrective Action Identification

When the Corporate QCM determines that a corrective action(s) for a nonconformance is appropriate and required, a CAR (Appendix K) will be issued to the responsible organization. Generally, corrective actions will be required for all non-conformances determined to be significantly adverse to quality in accordance with the following guidelines:

- Failure of the procedural system to produce the results specified in plans, procedures, specifications, and other project requirements
- Identification of repetitive nonconforming conditions for which previous corrective actions have been ineffective
- Repeated failure to comply with subcontract requirements, plans, and procedures
- Significant deficiencies found during the review or validation of data.

10.5 Corrective Action Request

Significant nonconforming conditions will be documented on the CAR and submitted to the responsible organization. Each CAR will specify:

- CAR identification number and date
- Responsible organization
- Nature of the nonconformance requiring corrective action (including the specific requirement or specification violated)
- Response due date
- Date of disposition
- Disposition and verification information
- Date corrective action is verified

10.6 Corrective Action Disposition

The CARs will require the responsible party to submit a written response, including:

- The steps that have been taken or will be taken to correct the condition reported in the CAR
- The cause that led to the condition reported in the CAR
- The steps that have or will be taken to preclude recurrence
- The dates when the indicated corrective action was or will be complete.

The response to the CAR will be evaluated by the Corporate QCM. Acceptance will be documented on the CAR and the date when implementation of the stated actions can be verified. Implementation of the corrective action, as stated in the response, will be verified by the Corporate QCM prior to closeout of the CAR. Unacceptable responses to CARs will be noted on the CAR and returned to the responsible organization to reissue the response. Failure to respond to CARs may result in the issuance of a Stop Work Order (SWO) by the Corporate QCM.

10.7 Stop Work Authority

The PM and Corporate QCM have the authority to stop or control further processing of activities that, in the opinion of the Corporate QCM, are uncontrolled or nonconforming and, if not corrected, could affect the quality of the project or jeopardize the accomplishment of project goals or result in significant rework. Stop work actions will be coordinated through the PM with input from Corporate CDM. Stop work actions will only be implemented when conditions exist which cannot be resolved through the nonconformance system or normal construction processes. Conditions which threaten safety, health, the public, or the environment will be brought to the attention of the Site Health and Safety Officer (SHSO) for action, unless the conditions pose an immediate danger, whereby the work will be stopped immediately by the Site QCM, PM, Site Supervisor, SHSO, or individual responsible for the work being performed.

10.8 Stop Work Orders

Upon determination by the Site QCM that the criteria for a Stop Work Order (SWO) applies, the Corporate QCM and PM will be notified verbally. The Corporate QCM will then verbally notify the applicable organization of the intent to stop work, when the SWO becomes effective, and the activities to which the SWO applies. The SWO (Appendix K) will be issued in writing by the Corporate QCM to the PM and the applicable organizations. In addition, CDM will be notified within two hours of an SWO.

The Corporate QCM, Site QCM, PM, and the responsible party will agree upon a corrective action plan and a date for implementation. The Corporate QCM and PM will sign the SWO signifying agreement with the corrective action required. The responsible party will implement the required corrective action, upon resumption of work activities, and notify the Site QCM when the corrective action has been completed. Upon verification of satisfactory correction of the nonconforming conditions, the Corporate QCM will cancel the SWO and give notice to the PM and the responsible party that normal operations may resume for that activity.

11.0 Change Control

During the course of field activities, it may become necessary to request approval to vary from approved plans or specifications. This section discusses the procedures for implementing changes to plans or specifications, including Field Work Variances (FWVs) and Change Orders.

11.1 Field Work Variance

Changes to approved plans, specifications, or O&M procedures may be required based on unanticipated field conditions or identification of improved methods or procedures. Requests to vary from approved documents will be submitted to CDM using a Field Work Variance (FWV) (Appendix L). The FWV will be completed by the PM or Site QCM and will include the following information:

- Description of present work requirements
- Description of proposed change
- Technical justification/rationale
- Document(s) requiring change
- Cost and schedule impacts.

Field Work Variances will be submitted to the CDM for approval within 24 hours of the time that the FWV was discussed with CDM. Prior to submittal to CDM, the completed FWVs will be reviewed by the Site QCM to verify that applicable quality requirements are incorporated. Approval of FWVs does not give the contractor authority to proceed with additional work. Rather, changes to the SOW, contract price, or project schedule will be approved through Change Orders in accordance Section 11.2. Upon approval of the FWV, CDM may issue a Work Directive Change to Arrowhead. The Work Directive Change authorizes Arrowhead to proceed with the change or variance to the SOW prior to issuing a formal Change Order.

Minor changes/variance to the SOW can be implemented in the field prior to FWV approval from CDM. Minor variances are defined as those variances that do not affect contract price, schedule, quality, or quantities. (In contrast, major variances initially require a Work Directive Change prior to implementation. Major variances have an impact on the contract price and project schedule and eventually are documented in Change Orders.) Upon approval of a minor variance, CDM will issue a Field Order to Arrowhead. The Field Order authorizes Arrowhead to proceed with the minor variance to the SOW as described in the FWV. A Field Order may also be used to interpret/clarify contract documents and/or document negotiated agreements.

11.2 Change Orders

Change Orders describe changes to the SOW, including an accounting of the adjustment in the contract price and/or project schedule. A Change Order will also contain revised contract documents/specifications to define the details of the change. Prior to a Change Order, CDM may issue a Work Directive Change (refer to Section 11.1), which authorizes Arrowhead to proceed with a change for subsequent incorporation in the Change Order. Conversely, CDM may begin the change order process by submitting a Request for Proposal (RFP) to Arrowhead. Change Orders shall be substantiated by a cost proposal from Arrowhead. The proposal shall include all necessary data (labor, equipment, products, taxes, bonds, overhead, profit, etc.) to support an adjustment to the contract price, as applicable. Proposals may be lump/sum fixed price, unit price, or time-and-materials as directed by CDM. Change Orders will be processed in accordance with the specifications.

11.3 Change Documentation

Field Work Variances will be controlled and maintained in the record file system in accordance with the procedures outlined in Section 5.4. Approved FWV documents will be forwarded to controlled document holders. Changes to plans or documents as a result of implementation of FWVs will be incorporated into the affected plan or document during the next revision.

12.0 Subcontractor Control

This section describes the controls for ensuring that Arrowhead subcontractors comply with project QC requirements.

12.1 Subcontractor Requirements and Responsibilities

The Arrowhead PM, Corporate QCM, and Subcontracts Manager are responsible for identification of all technical and quality requirements included in subcontract agreements and POs. The requirements for personnel qualifications, technical performance levels, QC procedures, applicable specifications and standards, acceptability levels, and documentation will be included as a part of the subcontract/PO documents as discussed in Section 6.0. All subcontractors performing work on this project are responsible for compliance to the requirements of their respective subcontract/PO. Subcontractors are required to implement internal QC procedures to ensure that the items or services that they provide are in compliance with the subcontract/PO requirements.

12.2 Subcontractor Monitoring

Arrowhead has the overall responsibility for conformance to the quality requirements for subcontracted items and services. The Corporate and/or Site QCM are responsible for the implementation of inspections, document reviews, design review, and other QC activities for monitoring subcontractor performance relative to the subcontract specifications. Using these methods, Arrowhead will determine whether the subcontractor is complying with project QC measures, including:

- Meeting quality requirements
- Generating, controlling, and maintaining required documentation
- Performing and documenting required inspections and tests
- Identifying, reporting, and correcting nonconforming conditions

These activities will be documented on inspection forms, Monthly O&M Reports, and other forms as outlined in this CQCP. In addition, subcontractors working on-site will be required to document their daily work activities on a Subcontractor Daily Tracking Log (Appendix M) or equivalent form. The Subcontractor Daily Tracking Log will contain the following minimum information:

- Description of work performed by the subcontractor
- Manpower summary (name, trade, and hours worked)
- Heavy equipment used on-site
- Materials received or consumed
- Copies of applicable testing results

12.3 Subcontractor Noncompliance

Testing or other work performed by subcontractors that does not conform to specified requirements will be identified, reported, controlled, corrected, and tracked in accordance with Section 10.0. Notification of subcontractor nonconformance will be accomplished via the NCR. Notification will be provided as soon as the nonconforming work has been identified and jointly confirmed by the PM and Corporate QCM.

12.4 Subcontractor Corrective Actions

As necessary, corrective actions on the part of a subcontractor will be required by means of a CAR, issued by Arrowhead. Corrective actions implemented by subcontractors will be monitored and documented by the Corporate QCM or designee to verify that the subcontractor's performance meets the required specifications. The PM and Corporate QCM has the authority to stop work by subcontractors in accordance with Section 10.7.

13.0 Material Receipt and Inspection

This section describes the inspections that will be conducted upon receipt of items or materials to be used during construction of the groundwater extraction and treatment system. Receipt inspections will be conducted by the QCM or his designee to ensure compliance with the QC requirements set forth in the PO, including applicable design/construction specifications.

Receipt inspections for items purchased to support field activities (i.e., gloves, rental equipment, hand tools, and other items that are not associated with specific quality requirements) will be performed by the Procurement Administrator for verification of type and quantity.

13.1 Inspection

Upon receipt, the QCM, Procurement Administrator, or the inspector will examine the items or materials to ensure that they meet the quality requirements specified in the subcontract/PO. The inspector will compare the shipping documents (i.e., bill of lading, weight tickets, etc.) and the item or materials with the purchase order requirements and note any discrepancies in material specifications, schedules, thickness, sizes, make, model numbers, or other physical properties. Apparent damages or shortages will be noted on the Receipt Inspection Form (Appendix N) and the shipping documents and reported to the Procurement Administrator. Additionally, the shipment will be checked for the presence of the proper supporting documentation, such as factory test results, certificates of compliance, and mill certificates. Chemicals and other materials must be accompanied by Material Safety Data Sheets (MSDSs). Receipt inspections will not include operational or performance testing of items or components.

13.2 Rejection

The basis for rejection of shipments will be documented on the Receipt Inspection Form and shipping documents. The PM and Procurement Administrator will be notified that the shipment is going to be rejected and the basis for rejection. Items/materials will not be returned to suppliers or vendors without authorization from the PM or QCM.

13.3 Acceptance

If the items or materials meet the PO requirements and no visual deficiencies are observed, the QCM or inspector will document acceptance on the Receipt Inspection Form and release the item/material for use. The completed Receipt Inspection Form will be included in the DQCR. After items or materials have been inspected and approved for use, they will be released to the

Site Supervisor. The items or materials will be stored in a secure area to protect physical and operational characteristics from damage, deterioration, theft, or tampering. The Procurement Administrator will revise inventories as required.

13.4 Conditional Use

When supporting documentation is not provided with the shipment but the item otherwise meets the PO requirements, the QCM may issue a conditional release for the item. The conditional release will be temporary and will allow for use of the item contingent upon future receipt of the missing documentation. If requests for documentation are unsuccessful, the QCM will revoke the conditional release and notify the PM. The PM will resolve the documentation problem or an NCR will be issued to track the nonconformance.

14.0 References

American Society of Testing and Materials (ASTM). 1996. *Annual Book of ASTM Standards*, Volume 04.08, Soil and Rock.

CDM Federal Programs Corporation, 2010, *Final Remedial Design, Old Roosevelt Field Contaminated Groundwater Area Superfund Site, Garden City, Nassau County, New York*

International Standards Organization (ISO), 1994, *Quality Management and Quality System Elements Guidelines*.

U.S. Army Corps of Engineers (USACE), 1993, *Engineering and Design, Quality Management*, ER 1110-1-12, Washington, D.C.

U.S. Department of Energy (DOE), 1991, *Quality Assurance*, DOE Order 5700.6c, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 2000, *EPA Quality Manual for Environmental Programs*, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 2001, *EPA Requirements for Quality Management Plans, QA/R-2*, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 2007, *Record of Decision, Old Roosevelt Field Contaminated Groundwater Area Superfund Site, Garden City, Nassau County, New York*

Tables

Table 2-1
Project Personnel and Responsibilities

Name	Telephone Number(s)	Responsibility
Mr. Thomas Mathew	(732) 590-4638 office	CDM Project Manager
TBD		CDM Field Representative
Mr. Ali Rahmani	(732) 590-4727 office	CDM Project Engineer
Mr. Vernon Wimberley	(703) 968-0900 office	CDM Contracting Officer
Mr. Doug Ronk	(913) 461-3805 cell	Arrowhead Project Manager
Mr. Scott Siegwald, CIH	(913) 814-9994 office (913) 461-3804 cell	Arrowhead Corporate Health and Safety Officer
Mr. Bryant Kroutch	(913) 814-9994 office (913) 461-3809 cell	Arrowhead Corporate Quality Control Manager
Mr. Greg Wallace	(913) 814-9994 office (913) 461-3828 cell	Arrowhead Project Quality Control Manager
Mr. Joe Cotter	(913) 961-5257 cell	Arrowhead Site Supervisor
Mr. Jon Simpson	(856) 296-3435	Arrowhead Site Quality Assurance Officer /Designated Safety Coordinator

Table 9-1
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant Construction
Definable Feature of Work Inspection Log

Definable Feature of Work	Applicable Specification Section	Applicable QAPP Table	3-Phase Inspection Process			Notes
			Preparatory (Date Completed)	Initial (Date Completed)	Follow-Up (Date Completed)	
Clearing and grubbing	2100	NA				
Yard piping trenching and installation	15200	NA				
Site utility installation	16600	NA				
Stormwater basin rehabilitation	2100	NA				
Effluent outfall manhole termination	15200	NA				
Extraction wellhead construction	15200	NA				
Extraction well pump installation	11319	NA				
Treatment plant foundation construction						
- Footers	3100, 3150, 3200, 3300	NA				
- Foundation walls	3100, 3150, 3200, 3300	NA				
- Floor slab	3100, 3150, 3200, 3300	NA				
- Housekeeping pads	3100, 3150, 3200, 3300	NA				
Pre-engineered metal building erection	13122	NA				
Construction of interior walls and rooms (control room, bathroom, etc.)	13122	NA				
Groundwater treatment system equipment installation	13300	NA				
Installation of secondary electrical service	16375	NA				
Rough-in of electrical equipment	16000, 16110, 16141, 16191, 16402, 16470, 16721	NA				
Installation of electrical fixtures (lighting, receptacles, and accessories)	16000, 16110, 16141, 16191, 16402, 16470, 16721	NA				
Installation of electrical panel boards and motors control centers	16261, 16470	NA				
Installation of process control equipment	13405	NA				
Installation of potable water supply piping, fittings, and support	2510	NA				
Site grading and restoration	2300	NA				
Asphalt roadway construction/repair	2576	NA				
System start-up and performance testing	1800	NA				
Chemical data acquisition	1800	18				
Operation and maintenance	1800, 1850	18				

Table 9-2
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant Construction
Quality Control Test Summary

Test	Location	Applicable Specification Section	Applicable QAPP Table	Test Frequency	Responsible Party
Geotechnical soil testing	2 borings up to 25 feet in depth located within building footprint. Final locations to be determined by Geotechnical Engineer.	2300	18	5 samples per boring	Arrowhead
Backfill material certification	Material source.	2300	18	1 per 5,000CY	Test America
Excess soil sampling	Onsite stockpiled excess soil	2300	18	TBD	Test America
Standard proctor/grain size (import material)	Material source.	2300	18	1 per 500CY	TBD
Standard proctor/grain size (site soils)	Onsite stockpiled soil	2300	18	1, see note 1.	TBD
In-place soil density test (building)	Treatment building	2300	NA	1 per 500CY	TBD
In-place soil density test (yard piping backfill)	Yard piping trench	2300	NA	1 per 200 linear feet	TBD
Yard piping pressure testing	Well EVW-1S	15200	NA	1	Arrowhead
	Well EVW-1I	15200	NA	1	Arrowhead
	Well EVW-1D	15200	NA	1	Arrowhead
	Effluent discharge	15200	NA	1	Arrowhead
Potable water line pressure testing	Potable water line between service connection and treatment plant	2510	NA	1	Arrowhead
Concrete compressive strength	Building footer	3300	NA	One per day, nor less than one set per 150CY, or 5,000SF	TBD
	Building foundation wall	3300	NA	One per day, nor less than one set per 150CY, or 5,000SF	TBD
	Building floor	3300	NA	One per day, nor less than one set per 150CY, or 5,000SF	TBD
Security system operation/function	Security panel, door switches, camera	13122	NA	1	Arrowhead
Misc. HVAC controls	Thermostat operation	13122	NA	1	Arrowhead
	Motor operated louver operation	13122	NA	1	Arrowhead
	Electric unit heater operation	13122	NA	1	Arrowhead
	Heat pump operation (cool and heat)	13122	NA	1	Arrowhead
	Chemical room ventilation fan	13122	NA	1	Arrowhead
	Chemical room heater	13122	NA	1	Arrowhead
Misc. building function	Operation of overhead door	13122	NA	1	Arrowhead
	Operation of personnel doors and closers	13122	NA	1	Arrowhead
	Window operation	13122	NA	1	Arrowhead
	Fit/finish of exterior building components	13122	NA	1	Arrowhead
	Fit/finish of interior building components	13122	NA	1	Arrowhead
	Final grading at building	13122	NA	1	Arrowhead

Table 9-2
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant Construction
Quality Control Test Summary

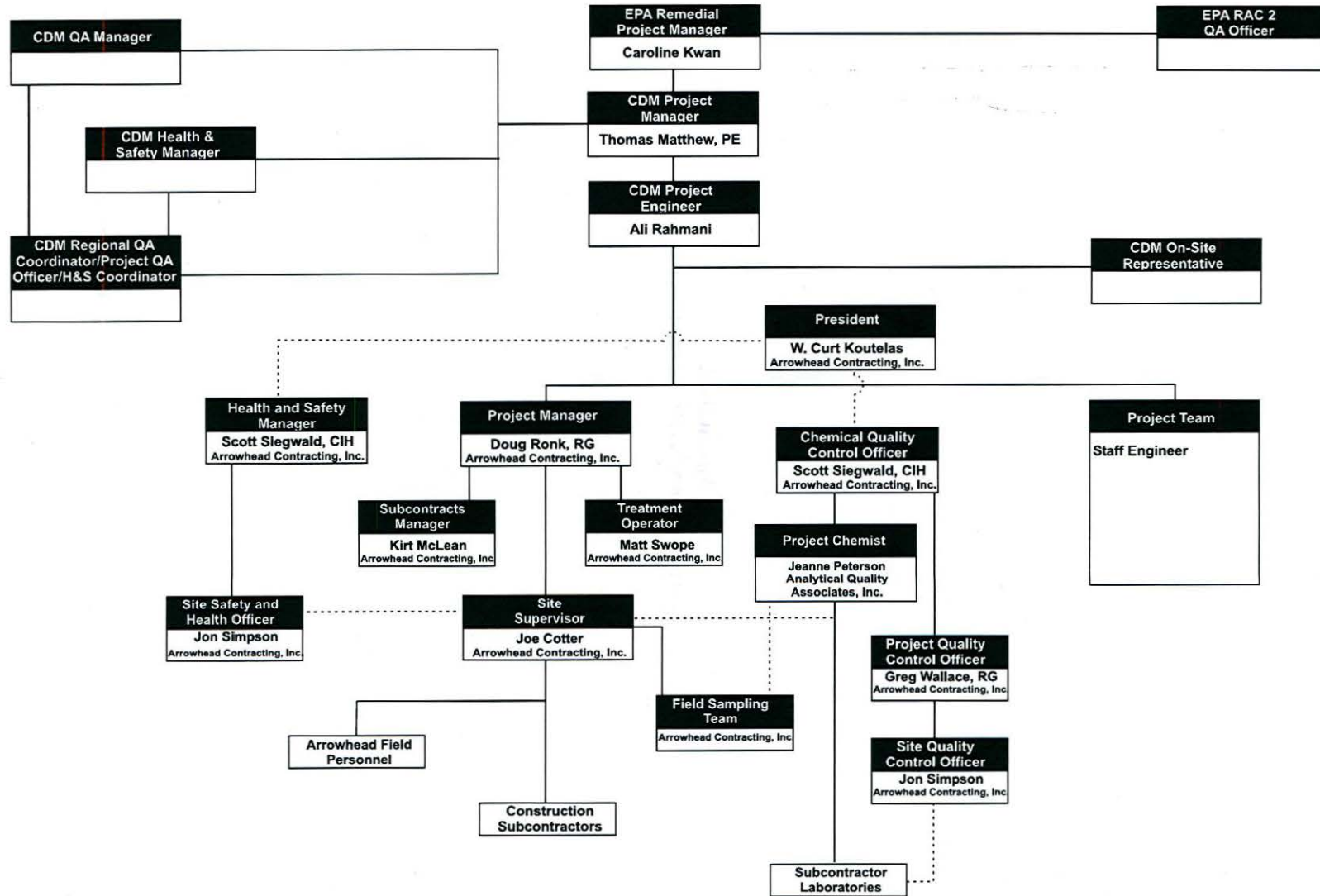
Test	Location	Applicable Specification Section	Applicable QAPP Table	Test Frequency	Responsible Party
Electrical testing	Secondary service voltage	16261	NA	1	Arrowhead
	Secondary service phase balance	16261	NA	1	Arrowhead
	VFD operation	16261	NA	1	Arrowhead
	Circuit breaker operation	16402	NA	1	Arrowhead
	GFCI operation	16402	NA	1	Arrowhead
	Motor rotation	16220	NA	1	Arrowhead
	Voltage at each device	16402	NA	1	Arrowhead
	Phase balance at each 3-phase motor	16220	NA	1	Arrowhead
	Ground testing - between phase and ground, each device	16600	NA	1	Arrowhead
Control system operation/functionality testing	To be developed as design is completed	13405, 13410	NA	1	Arrowhead
Initial Testing Program	48 hour test	1800	18	Varies by location	Arrowhead/Test America
	14 day test	1800	18	Varies by location	Arrowhead/Test America

Notes:

1. Additional proctor samples to be collected as requested by Site QCM.

Figures

Figure 2-1
Project Organization Chart



Appendix A
Quality Control Authorization Letter



January 26, 2011

RE: Site Quality Control Manager
Old Roosevelt Field Superfund Site Remedial Construction Services
CDM Subcontract No. 3320-023-001-CNS

To Whom It May Concern:

This Letter of Direction authorizes Mr. Jon Simpson to act as the Site Quality Control Manager on the above referenced contract. He is authorized to perform all duties outlined in the attached project Quality Control Plan.

Mr. Simpson will be responsible for preparing and maintaining the Submittal Register From 4288 for the duration of the project. He will also be responsible for review and approval of all submittal documents to ensure compliance with applicable specifications, drawings, and to the quality of materials proposed for use. This applies to all subcontractors, offsite fabricators, and suppliers. He will be responsible for reviewing all test data for compliance with applicable specifications.

Sincerely,

A handwritten signature in black ink, appearing to read "B. Kroutch", is written over a horizontal line.

Bryant Kroutch, PE
Corporate Quality Control Officer

Appendix B
Quality Control Personnel Resumes

Bryant Kroutch, PE
CORPORATE QUALITY CONTROL MANAGER

ARROWHEAD CONTRACTING, INC.

TOTAL YEARS EXPERIENCE: 25

EXPERIENCE WITH OTHER FIRMS:

1990–1999, IT Corporation

1986–1990, ICF Kaiser

Engineers

PROFESSIONAL REGISTRATION:

PE IN WASHINGTON & KANSAS

EDUCATION:

Montana College of Mineral
Science and Technology: BS,

Petroleum Engineering, 1985

PROFESSIONAL REGISTRATION:

PE, Kansas and Washington

QUALIFICATION HIGHLIGHTS:

- ◆ 25+ years experience managing General Construction and HTRW contracts
- ◆ Managed up to 20 concurrent TOs ranging in value from \$25K to \$2.5M.
- ◆ Experience managing FFP, CPFF and T&M TOs.
- ◆ Project/construction manager/CQC manager for a diverse resume of general, civil and environmental construction projects.
- ◆ Well rounded experience including program and project level management of construction services and Construction Quality Control

RELEVANT PROJECT EXPERIENCE

Mr. Kroutch is a registered Professional Engineer with 25 years of experience in successfully managing and performing multi-faceted, cost-reimbursable and firm-fixed-price, turnkey programs and projects for the federal government and commercial clientele. As Arrowhead's Quality Control Principal, Mr. Kroutch participates in the direction and oversight of all Arrowhead general and remedial construction endeavors.

Program Construction/CQC Manager, Guardian Installation Protection Program. As a fully integrated team member for this FFP, ID/IQ contract, under Mr. Kroutch's direct oversight, Arrowhead worked closely with the prime contractor during the early planning stages of the Task Order to provide constructability reviews, develop submittal registers, quality control requirements and jointly established a master construction schedule. Ongoing projects under this program entail a variety of traditional vertical and horizontal MILCON type construction service and a broad range of CBRN detection systems and Command, Control, Communication, Computers and Intelligence (C4I) equipment. Arrowhead has executed 84 design or construction task orders totaling in excess of \$23 million at 100 military facilities.

Program Construction Manager/CQC Manager, NOAA Central Region and NOAA Western Region Construction MATOCs. Construction/CQC Manager for Arrowhead's ongoing role under two, five-year, nationwide ID/IQ program for design-build, general construction services at nationwide, NOAA facilities. To date over \$8M in Task Orders encompassing a wide range of new construction and renovation services including emergency response to repair facilities in the Gulf Coast following Hurricane Katrina. Task Order projects ranged from \$3200K to \$1.7M.

CQC/Construction Manager, Hastings, NE - Blaine NAD, USACE. Provided engineering/construction services in support of CERCLA remedial investigation, remedial design, and operations of remedial systems. Responsibilities included: subcontracting, health and safety, QC, invoicing, vendor payments, site investigations, engineering design, construction, public relations, and project closeout. Remedial construction under his direction included five soil vapor extraction systems, an enhanced bioremediation/air sparging system for groundwater, an engineered landfill cover, and several excavation/site restoration plans.

Engineering/QC Manager, FUSRAP, Madison Site (PRAC), USACE. Managed the surface decontamination and removal of 60,000-pounds of uranium-contaminated dust from overhead structures within a large, 130,000-square-foot, extrusion press facility. Conducted an accessibility study and designed two working platforms that were constructed on top of existing overhead cranes to provide workers unencumbered access to the overhead structures.

Construction/QC Manager, St. Louis Downtown FUSRAP Site, USACE. Oversight of management and transportation services at a large, complex FUSRAP site under the direction of the USACE St. Louis District. Managed the storage, loading, and transporting of Class 7, 9, and exempt LLRW. The scope included successfully transporting over 70,000 tons of LLRW from the St. Louis Downtown FUSRAP Site to various disposal facilities throughout the Western United States.

PROJECT QUALITY
Greg Wallace, RG

CONTROL OFFICER

ARROWHEAD CONTRACTING, INC.

Total Years Experience: 26

EDUCATION

Colorado State University: B.S.,
Geology, 1983

PROFESSIONAL REGISTRATION

RG in KS and MO

QUALIFICATION HIGHLIGHTS

- ◆ Is responsible for oversight and management of eight projects with CDM
- ◆ Mr. Wallace is a nationally recognized expert in the design, construction, and operation of groundwater treatment systems. He has been recognized for his technical accomplishments with a number of prestigious awards including the President's Design Award, the USACE Grand Award for Engineering Excellence, the USACE Engineering Excellence Award, and the Chief of Engineers' Design Honor Award

EXPERIENCE WITH OTHER FIRMS

1998-2000, URS Corp., PM,
1987-1998, Woodward Clyde, PM
1985-1987, Black & Veatch, PM
1983-1985, Denver Water Board,
PM

REGULATORY KNOWLEDGE

RCRA, CERCLA, TSCA, SWDA,
NPDES, CAA, CWA, DOT - Various
State, Federal, and Local; EPA
Regions: 2, 3, 4, 5, 6, 7, 8, 9

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Program Manager, Tutu Wellfield, Region 2, Superfund Site, St. Thomas Virgin Islands (2003 to ongoing O&M). Design-build contract to build two groundwater remediation systems and one SVE system. Arrowhead prepared a detailed design package and implemented a Remedial Action (RA) at the Tutu Wells Superfund Site. The RA includes cleanup of the source soils and site-wide groundwater. Groundwater cleanup includes the installation of recovery wells to contain the spread of groundwater contamination, and construction of two treatment facilities to treat the extracted groundwater. In-situ SVE treatment addresses areas of concern, source soils. Principal components of the construction included nine new wells, two concrete process-buildings featuring the Royal Building System, earth retaining structures, yard piping, concrete equipment pads, process equipment, systems controls, and site restoration. Arrowhead is now in the fourth year of Operation and Maintenance at the site.

Program Manager, Mead NOP Superfund, Mead, NE, CENWD, (2006-2010). Managed the design, installation, and prove-out of three, separate, competitively bid, TCE contaminated groundwater treatment system(s) at the former Mead Naval Ordnance Plant (NOP). The design/construction components included water treatment plant buildings, process equipment, and site preparation. Technology included hydraulic control/air stripping and Advanced Oxidation Processes to treat contaminated groundwater.

Project Manager, 10th Street Superfund Site, Columbus, Nebraska

Mr. Wallace was the Project Manager for a \$1.72 Million design-build firm fixed fee contract by CDM Federal Programs Corp. to construct a groundwater extraction and treatment system (GETS) as an Interim Remedial Action at the 10th Street Superfund Site (Operable Unit 2) in Columbus, Nebraska. The GETS constructed by Arrowhead is comprised of four extraction wells, over 3,500 feet of HDPE interconnecting piping, operates at a design flow rate of 1500 gpm, and provides on-site treatment utilizing air stripping technology. The design incorporated a fiberglass equalization tank to receive water from all of the extraction wells, filtration equipment for pre-treatment, chemical addition of sequestrant to enhance the finished product (as well as reduce the potential for fouling of the air stripper), and a unique discharge system design that allows the City the flexibility to accept 0 to 100% of the treated water flow to the City water supply.

Program Manager, Mead Superfund NOP, Mead, NE Program Manager for design, installation, and prove-out of a TCE contaminated groundwater treatment system at the former Mead Naval Ordnance Plant (NOP), Mead, Nebraska.

Project Manager, Vienna PCE Superfund Site, WV, (2004-2005). Program Manager for design and construction of four air sparge/soil vapor extraction systems involving over 100 sparge points and 22 SVE points. The project also includes two pre-engineered metal wastewater process buildings, two prefabricated wastewater process buildings, 37,000 linear feet of sparge lines, 13,000 linear feet of SVE lines, and over 4,000 linear

Program Manager, Celotex Superfund Residential Removal, Chicago, IL (2007). Managed this time-sensitive, highly complex, contaminated soil removal action in a high-density, residential neighborhood in downtown Chicago. Continuous, ad-hoc field engineering and innovation was necessary to keep the project on track and schedule. Close coordination with the project and the community stakeholders was integral to this highly successful project.

Program Manager, McGregor NWIRP, Navy, McGregor, TX, (2003 – 2005). Managed excavation, treatment and disposal of approximately 6,250 cy of perchlorate-, metals-, and VOC-impacted soils, located at 15 buildings. This project was a three-phase, multi-media project requiring: removal, treatment, and disposal, passive bio-trench and bio-borings and installation of additional bio-trenches and closure of onsite landfills.

Program Manager, Multiple Award Task Order Contract, USACE.

Program Manager for Arrowhead's \$15M, 3-year FFP, ID/IQ, design-build contract with the USACE, Kansas City District to execute general construction Task Orders throughout the Central U.S.

Program Manager, USACE Kansas City District, Pre-Placed Remedial Action Contract.

Five-year ID/IQ program executing remedial action task orders throughout the Central U.S. Included both cost-reimbursable and fixed-price projects.

Program Manager, USEPA, Region VIII, Small Business RAC.

Program Manager for Arrowhead's \$3M, five-year -duration, ID/IQ contract with the USEPA to perform site investigations and execute resulting remedial action at abandoned UST sites throughout the Western and Central U.S.

Project Manager, St. Louis Army Ammunition Plant, St. Louis, Missouri

Project Manager for the investigation and remediation of PCB contamination at the St. Louis Army Ammunition Plant. This project represents a \$6.3 million delivery order under Arrowhead's PRAC with the USACE, Kansas City District and includes the removal and disposal of 1,121 tons of concrete flooring from within an old production facility, removal of 866 tons of contaminated soil and waste materials from around the production building footprint, demolition of a 170,000 square foot, three story building structure, and removal of over 1,000 tons of contaminated soil beneath the building footprint.. Strict waste characterization, compliance with TSDF regulations and requirements was critical to the success of this fast track, mission critical project.

Program Manager, USACE Kansas City District, Pre-Placed Remedial Action Contract.

Five-year ID/IQ program executing remedial action task orders throughout the Central U.S. Included both cost-reimbursable and fixed-price projects.

Environmental Technical Lead and Project Manager, U.S. Army Corps of Engineers, Total Environmental Restoration Contract (TERC).

Environmental Technical Lead and Project Manager for Arrowhead's ongoing role under a \$270M, 10-year cost-reimbursable ID/IQ contract. Arrowhead is a contractual team member; under a large-business led consortium that was awarded this contract from the USACE, Kansas City District. The scope of services provided through this contract involves the life-cycle environmental restoration of impaired federal properties and associated general construction. To date, Arrowhead has been awarded 17 subcontract task orders ranging in value from \$5K to \$3.5M. The aggregate value of all task orders to date exceeds \$12M. Representative experience under this contract includes:

- **Blaine NAD Superfund Site, Hastings, Nebraska, (CENWD)**

Project Manager for characterization, remedial design, and remediation activities at the former Blaine NAD. Projects were conducted under a Site Specific ID/IQ Contract with USACE KC. Example task orders included development of regional fate and transport groundwater model; design, construction, and operation of the Multiple Technologies Facility (MTF) to conduct pilot studies of deep horizontal air sparging techniques and enhanced bioremediation; Remedial Investigation (RI) of 7 square miles of VOC plumes and 4 square mile of explosive plumes; RI of soil contamination in 9 square miles of production facility areas; design of Soil Vapor Extraction Systems; and, annual groundwater sampling of hundreds of monitoring wells. Representative documentation included Sampling and Analysis Plans; Safety, Health, and Emergency Response Plans; Quality Control Plans; Technical Memoranda; RI Reports; Preliminary Contamination Assessment Summaries; Feasibility Studies; Engineering Evaluation and Cost Analysis; Proposed Plans; Record of Decision; Removal Action Work Plans and other design documents; and, Construction Summary Reports. Community involvement included regular participation in RAB Meetings.

PROJECT SITE SUPERINTENDENT
Joe Cotter

ARROWHEAD CONTRACTING, INC.

TOTAL YEARS EXPERIENCE: 7

EDUCATION

Southwest Missouri State University,
BS, Industrial Management, 2003

PROFESSIONAL REGISTRATION

CQM Certification, USACE
OSHA 40-Hour Hazardous Waste
Activities Training
OSHA 8-Hour Refresher for
Hazardous Waste Activities

REGULATORY KNOWLEDGE

RCRA, CERCLA, OSHA, DOT –
Various State, Federal, Local regs;
EPA Regions: 3, 6, 7, 8

QUALIFICATION HIGHLIGHTS

- ◆ Significant field QC experience on USACE led construction projects.
- ◆ Diversity of ID/IQ, remedial, civil and general construction projects primarily for federal agencies and/or private sector clients

DEMONSTRATED PERFORMANCE RECORD

- ✓ USACE CQC field managed QA/QC program/project activities on Superfund and general construction and homeland security sites
- ✓ Diversity of highly successful clean/remediation construction oversight projects

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Mr. Cotter is a Construction Superintendent/CQC Manager with over seven years of experience under a variety of civil/general construction projects for federal agencies. Duties include a variety of site construction and QC functions depending on project requirements. Typical responsibilities include review of subcontractor proposals and contracts for compliance with regulations; preparation of work plans, cost estimates, and project schedules; requisition of equipment and materials; performance of QA/QC inspections, preparation of reports, supervision of subcontractors/suppliers and coordination with a variety of project stakeholders. Mr. Cotter maintains a comprehensive understanding of government procurement, subcontract administration, property management, and contract administration procedures.

Site Superintendent, Guardian Installation Protection Program, (2005-present). Ongoing projects under this program entail a variety of traditional vertical and horizontal MILCON type construction service and a broad range of CBRN detection systems and Command, Control, Communication, Computers and Intelligence (C4I) equipment. Mr. Cotter has participated in a significant portion of Arrowhead's design or construction task orders totaling in excess of \$23 million at 100 military facilities nationwide and internationally.

Site Superintendent/CQC Manager, N. Penn Area 7 Superfund Site, OU-2, North Wales, PA (2009). Quality Control Manager for a \$1.6M, firm fixed-price soil remedial action. Included surgical excavation, demolition, unforeseen contamination accommodations surrounding subsurface contamination. Included pre-excavation subsurface characterization that facilitated efficient excavation/live loading of soils and discovery of unknown conditions. Site restoration activities included backfilling and grading site to ensure compliance with stormwater management plan.

Site Superintendent/CQC Manager, NWIRP Remediation, Dallas, TX (2007-2008). Project included permeable reactive groundwater barrier installation, landfill cap construction, treatment cell upgrades, demolition of surface/subsurface structures, and soil remediation at a facility spanning nearly 10,000 acres. Site restoration activities included backfilling and grading site to ensure compliance with stormwater management plan.

Site Superintendent/CQC Manager, Naval Air Station, Kingsville, Texas (2007). Managed field remediation construction services associated with a UST removal and remediation effort that included the excavation, dewatering and temporary treatment of contaminated groundwater. Contaminated soils were staged and bioremediated for later use in site restoration. A total of 13,000 cy of clean soil was excavated and stockpiled and a total of 17,000 cy of petroleum contaminated soil was bioremediated ex-situ.

SITE QUALITY CONTROL MANAGER
Jon Simpson

ARROWHEAD CONTRACTING, INC.

TOTAL YEARS EXPERIENCE: 28

EDUCATION

BS, Geology, 1982, Tulane University
New Orleans, LA

PROFESSIONAL REGISTRATION

Profession Geologist, State of
Kentucky No. 2022
State of Texas, Licensed Well Driller

QUALIFICATION HIGHLIGHTS

- ◆ Seasoned environmental professional and project manager.
- ◆ Skilled in the application of geophysical techniques (surface & borehole) to site characterization.
- ◆ Proficient hydrogeologist skilled in the use of groundwater modeling and data analysis software.
- ◆ OSHA 40-Hour Hazardous Waste Activities Training
- ◆ OSHA 8-Hour Refresher for Hazardous Waste Activities (annual)
- ◆ Hazardous Waste Supervisor Training (1995)
- ◆ Applied Open & Cased Hole Log Interpretation & the Application of Geophysical Techniques (Schlumberger, Ltd)

DEMONSTRATED PERFORMANCE RECORD

- ✓ Proven manager with the technical skill and competency to meet goals of each project.
- ✓ Significant, practical field experience in subsurface investigation.

REGULATORY KNOWLEDGE

RCRA, CERCLA, NEPA
TNRCC Risk Reduction

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Project Manager/Lead Hydrogeologist, Celanese Chemical, Pampa, TX. Managed a large multi-million dollar project involving the groundwater quality assessment of a deep, multi layered perched water system and its influence on the underlying Ogallala Aquifer. This involved the design and installation of a network of deep multiple-cased monitoring and recovery wells.

Project Manager/Lead Hydrogeologist, Celanese Chemical, Pampa, TX. Developed and implemented work plans for the plugging, abandonment and closure of a deep (10,500-ft) hazardous waste disposal well. Directed and oversaw all activities which included well integrity testing, geophysical data acquisition, zone perforation, cementing and closure reporting.

Project Manager/Lead Hydrogeologist, Celanese Chemical, Clear Lake, TX. Project manager responsible for the budgeting, scheduling and implementation of all field programs and development of a regulatory strategy, for a RCRA facility investigation covering 36 solid waste management units.

Project Manager/Lead Hydrogeologist, Celanese Chemical, Pampa, TX. Managed a large project involving the design and installation of a groundwater monitor well network for a flyash landfill. This involved the installation of a network of deep multiple-cased monitoring wells.

Project Manager, City of Tomball, TX. As project manager, responsible for the field quality control of an installed clay liner at a municipal solid waste landfill. Developed and maintained a laboratory soils testing program outlining type and frequency of geo-technical testing.

Project Hydrogeologist, GATX Terminals Corporation, Galena Park, TX. Lead hydrogeologist responsible for the development and implementation of site characterization and closure plans for a hazardous waste holding basin. Managed the installation of a clay cover and lime stabilized clay cap. Performed all in-situ and laboratory verification testing.

Project Manager, Houston Lighting & Power, Webster, TX. Managed the installation of clay liners for several surface impoundments.

Project Hydrogeologist, Rohm & Haas, Deer Park, TX. Field manager for the closure of a large waste composting impoundment. Completed the necessary sampling, soil boring and monitor well installation. Sampled and performed the appropriate materials integrity testing of stabilized wastes within the impoundment. Monitored the installation of a clay cap; completed all field and laboratory verification testing.

SUBCONTRACTS MANAGER
Kirt McLean

ARROWHEAD CONTRACTING, INC.

TOTAL YEARS EXPERIENCE: 23

EDUCATION:

University of Missouri, Kansas City, 1989,
MS, Accounting (Tax Focus)
University of Missouri, Columbia, 1972, BS,
Engineering

PROFESSIONAL REGISTRATION:

◆ AICPA, MO Society of CPAs

QUALIFICATION HIGHLIGHTS:

- ◆ 23 years Federal and private sector finance, contract management, procurement experience; in depth knowledge of DFAR and AFAR.
- ◆ Significant experience with FFP and cost reimbursable (CPAF, CPIF, and CPFF) contracts.
- ◆ Provides internal and external Financial Management Training seminars for Project Managers.

DEMONSTRATED PERFORMANCE RECORD:

- ✓ Integral in the continued success and performance of numerous, Federal Contracts and Programs.

EXPERIENCE WITH OTHER FIRMS

July, 2007 – Present Arrowhead Contracting, Inc., Lenexa, Kansas, CFO
March, 2000-June, 2007, Larkin Group, Kansas City, Missouri, Controller
July, 1998-March, 2000, Tnemec Company, North Kansas City, Missouri, Operations Accountant and Property Manager
Jan to July, 1998, Acoustic Development Corp., St. Joseph, Missouri, Manager of Cost Accounting
1996-1998, R. Kirtley McLean, CPA, St. Joseph, Missouri, Management Consultant
Cargill & McLean, CPA's, St. Joseph, Missouri, Partner, 1989-1991
1972-1986, Camation Company, St. Joseph, Missouri, Department Manager

PAST PERFORMANCE PROJECT INVOLVEMENT:

Projects 4, 5, and 6

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Director of Accounting/Contracting, Arrowhead Contracting, Inc., (2007-present). Manages corporate accounting and contracts/subcontractor compliance for all company business. Duties include ensuring compliance with applicable Federal, regulations and policies, as well as the contract terms and conditions; maintaining MIS/purchasing system, includes overseeing procurement of subcontractors, national supplier/rental agreements.

Contracts Manager, Statewide MATOC, Missouri National Guard (2008 to present). Contract and Procurement administration functions under the 5-year Program to perform maintenance, renovation, construction and design/build services in support of MNG facilities, statewide.

Contracts Manager, MATOC - Levee Breach Repairs, USACE St. Louis District, (2008 – present). Responsible for Contract /Procurement functions under the \$3.5M, Multiple Task Order levee restoration/construction project. Managed Subcontractor procurement program and database for fast-track response to critical levee repair task orders.

Contracts Manager, MATOC, U.S. Fish and Wildlife Service, Region 3 (2007–present). Responsible for ensuring corporate compliance with contractual terms & conditions, and the FAR/DFAR for the 5-year Program to provide diverse design-build general/environmental construction.

Contracts Manager, MATOC, NOAA-Central Region, (June 2007 – present), Contract and Procurement administration functions under the 5-year Program for design-build, general/remedial construction services at NOAA facilities, nationwide. Program included significant subcontractor management and creative supply chain management because of disaster challenges.

Larkin Group, Kansas City, Missouri, March, 2000-June, 2007, Controller Report to the president and responsible for finance, administrative, and IT functions of a civil engineering firm. Streamlined general ledger and improved timeliness of financial reports. Worked with bank to extend line of credit with improved terms. Established new legal relationship. Planned the lay-out, build-out and move to new office space for the firm. Administrator for 401k plan. Provide financial management training for project managers. Review client and sub-consultant contracts. Implemented cash forecasting system. Direct accounting/administrative staff of four people and IT staff of one.

Tnemec Company, North Kansas City, Missouri, July, 1998-March, 2000, Operations Accountant and Property Manager

Maintained the fixed asset system. Coordinated independent auditor fieldwork in inventory, fixed assets and tax. Member of the Vice-President, Operations management team. Aided operating departments in preparation of operating and capital budgets. Appointed controller of a wholly owned subsidiary in addition to ongoing responsibilities.

Acoustic Development Corp., St. Joseph, Missouri, Jan to July, 1998, Manager of Cost Accounting

Directed the cost accounting efforts for the \$13 million manufacturing facility. Additional responsibilities included fixed asset management, serving as tax liaison with the independent auditors, and coordinating the installation of a new pc-based manufacturing/accounting software system (replacing JDEdwards system).

PROJECT MANAGER
Doug Ronk, RG

ARROWHEAD CONTRACTING, INC.

TOTAL YEARS EXPERIENCE: 11

EDUCATION:

Southern Illinois University at Carbondale,
M.S., Geology, 2003
Northwest Missouri State University, B.S.,
Geology, 1997

PROFESSIONAL REGISTRATION:

RG in Washington
US National Domestic Preparedness
Program Emergency Responder Nuclear,
Biological, and Chemical Responder
Operations

QUALIFICATION HIGHLIGHTS:

- ◆ 8 years experience managing ERS and HTRW contracts
- ◆ Managed up to 5 concurrent TOs over a wide Program geography
- ◆ Experience managing FFP, CPFF and T&M TOs
- ◆ Developed and implemented innovative pre-excavation sampling programs for live loading vs. staging – resulting in significant cost avoidance for client(s)

FEDERAL AND STATE REGULATORS

Worked closely with the client, USEPA R8, and the USFS to resolve numerous unforeseen conditions and address environment-ally and archeologically sensitive areas potentially impacted by site work

UTILITIES

Coordinated with numerous western-US city engineering departments/utility groups relative to drilling programs associated with investigative/ remedial activities under a Small Business RAC, Region 8

DEMONSTRATED PERFORMANCE RECORD:

- ✓ Performed as Project Manager, Site Manager, Site Safety Officer at numerous, diverse ERS sites
- ✓ Excellent record of Stakeholder management and communication

EXPERIENCE WITH OTHER FIRMS: N/A

REGULATORY KNOWLEDGE:

RCRA, CERCLA, TSCA, SWDA, NPDES, CAA, CWA, – Various State, Federal, and Local; EPA Regions: 2, 3, 4, 5, 6, 7, 8, 9

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Project Manager, Lawrence Aviation Superfund Site, Port Jefferson Station, New York (2010). Managed the performance-based, design, construction and operation contract for a groundwater extraction and treatment facility (GWTF); and, the implementation of an in-situ, chemical-oxidation (ISCO) remediation technology at a 42 acre TCE soil and groundwater contamination site.

Project Manager, Mead NOP Superfund, Mead, NE, CENWD, (2006-2010). Managed the design, installation, and prove-out of three, separate, competitively bid, TCE contaminated groundwater treatment system(s) at the former Mead Naval Ordnance Plant (NOP). The design/construction components included water treatment plant buildings, process equipment, and site preparation. Technology included hydraulic control/air stripping and Advanced Oxidation Processes to treat contaminated groundwater.

Project Manager, Colorado Crystal/Northrop Grumman, Loveland, Colorado (2009) – Design/build of a water treatment system/building at an active manufacturing facility to treat TCE contaminated groundwater and soil via nine SVE wells and six dual-phase extraction wells. The groundwater was treated to accommodate discharge permit limits via a low profile air stripper prior to formation injection.

Project Manager/Lead Field Geologist, Small Business RAC USEPA Region 8 (2006-2007). Project Manager for U.S. EPA's \$5 million contract to remediate LUST sites in the southwest US. Field efforts included completion of multi-phased site assessments, investigative drilling programs, contaminant sampling, natural attenuation evaluations, and performance of various remedial measures for contaminated soil/ groundwater.

Site Manager, Vienna PCE Superfund Site, West Virginia (2004-2005). Site Manager for the constructability evaluation and field construction of four, air sparge/soil vapor extraction systems involving over 100 sparge points and 22 SVE points. The project included two, pre-engineered metal process buildings; two, prefabricated process buildings, 37,000 LF of sparge lines, 13,000 LF of SVE lines, and over 4,000 LF of trench installed within an active commercial/residential districts.

Project Manager, Rimini Community Waste Water Treatment System, Rimini, Montana (2005-2006). Site Manager for the installation of a new wastewater treatment system and remediation of contaminated soils in the Upper Ten Mile Creek Mining Area site located in Rimini, Montana. As part of the Remedial Action, activities include excavation, management, and disposition of arsenic- and lead-contaminated soil, construction of a new bridge, a 48,000 gal. septic tank, a four inch dia. force main, a sanitary sewer main; and, installation of a 20,000 gal. treatment tank and construction of control buildings.

Asst. Project Manager, St. Louis Army Ammunition Plant, St. Louis, MO, USACE CENWD, (2000-2004). Fast-track, technically-challenging remediation including the excavation/removal and disposal of over approximately 7,500 tons of PCB contaminated concrete, soil, and waste and abatement of asbestos-containing materials. Responsible for material load-out, piping and utilities removal, demolition, pre-TSDF characterization sampling and testing, excavation and backfill operations, and waste transportation and disposal.

Appendix C
Training Forms

TRAINING ATTENDANCE RECORD

DATE: _____ LOCATION: _____

SUBJECT: _____

INSTRUCTOR(S): _____ HANDOUTS: _____

NUMBER OF HOURS: _____

PERSON(S) TRAINED:

[illegible]

Appendix D
Daily Quality Control Report



Daily Quality Control Report

REPORT NO. 1 SUBCONTRACT NO. 3320-023-001-CNS Date:

LOCATION OF WORK: Old Roosevelt Field Contaminated Groundwater Area Superfund Site,
Garden City, New York

DESCRIPTION OF WORK:

WEATHER CLASSIFICATION:

Class A	No interruptions of any kind from weather conditions occurring on this or previous shifts	Classification:
Class B	Weather occurred during this shift that caused a complete stoppage of work	Class: A
Class C	Weather occurred during this shift that caused a partial stoppage of work	Temperature
Class D	Weather overhead excellent or suitable for work during shift. Work completely stopped due to results of previous adverse weather.	Max 79°F Min. 65°F
Class E	Weather overhead excellent or suitable during shift but work partially stopped due to previous adverse manner.	Precipitation: None
Other	Explain:	Inches: 0.00"

- 1. Work Performed Today by ACI:**
- 2. Work Performed Today by Subcontractors:**
- 3. Location(s) of Work:**
- 4. List Type and Location of Tests Performed and Results of These Tests:**
- 5. Type and Results of Inspection: (include Satisfactory Work Completed or Deficiencies with Action to be taken).**
- 6. Location and Description of Non-Conformance and Corrective Actions:**
- 7. Instructions or Work Directives Received:**

8. Submittals Received and Reviewed:

9. Field Change Orders:

10. Remarks:

11. Safety Violations Observed:

12. Green Remediation:

13. CERTIFICATION: I certify that the above report is complete and correct and that I, or my authorized representative, have inspected all work performed this day by the contractor and each subcontractor and have determined that all materials, equipment, and workmanship are in strict compliance with the plans and specifications, except as may be noted above.

Site Quality Control Manager



*Arrowhead Contracting Inc.
Old Roosevelt Field Superfund Site
Garden City, New York
Remedial Construction Activities
Daily Quality Control Report
Labor Summary*

Date: 10/10/10

Employee Name	Trade	Work Summary		
		Straight Time	Overtime	Total
			Total	0

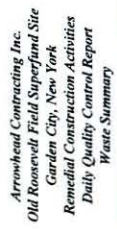
[illegible]



*Arrowhead Contracting Inc.
Old Roosevelt Field Superfund Site
Garden City, New York
Remedial Construction Activities
Daily Quality Control Report
Material Delivery Summary*

Date 10/10/2010

Material	Intended Use	Vendor	Quantity Delivered	Used	Stored	Notes



Appendix E
Monthly O&M Report

**MONTHLY OPERATIONS AND MAINTENANCE SUMMARY
OLD ROOSEVELT FIELD CONTAMINATED GROUNDWATER AREA SUPERFUND SITE
GARDEN CITY, NEW YORK**

CDM SUBCONTRACT NO.

Submitted to:

**CDM Federal Programs Corporation
110 Fieldcrest Avenue, 6th Floor
Edison, New Jersey 08837**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher
Lenexa, Kansas 66219**

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2-2	System Alarm Summary
3-1	Monthly SPDES Permit Equivalent Parameter Analytical Summary
3-2	Monthly Air Permit Equivalent Parameter Analytical Summary

List of Appendices

A	System Run Log
B	Compliance Sample Analytical Data - Water
C	Compliance Sample Analytical Data – Air
D	Data Validation Report

List of Acronyms

Arrowhead	Arrowhead Contracting, Inc.
CDM	CDM Federal Programs Corp.
gpm	Gallons per minute
GWTF	Groundwater treatment facility
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and maintenance
ORF	Old Roosevelt Field
TCE	Trichloroethylene
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound

1.0 Introduction

2.0 Operation Activities

2.1 *Operation Review*

2.2 *Planned Shutdowns*

2.3 *Unplanned Shutdowns*

3.0 Compliance Sampling

3.1 *Sampling Activities*

3.2 *Data Summary*

4.0 Maintenance Activities

5.0 Operational Problems Encountered and Remedies



Table 2-1
Old Roosevelt Field Superfund Site
Groundwater Treatment System
Operation Summary

Item	November 2010	Cummulative	Notes
Calender Days in Period			
Treatment System Runtime (hours)			
- EW-1S runtime			
- EW-1I runtime			
- EW-1D runtime			
- System runtime			
Treatment system downtime (hours)			
- Planned			
- Unplanned			
System uptime			
Treatment Summary			
- Gallons extracted from EW-1S			
- Average flow rate from EW-1S (gpm)			
- Gallons extracted from EW-1I			
- Average flow rate from EW-1I (gpm)			
- Gallons extracted from EW-1D			
- Average flow rate from EW-1D (gpm)			
- Total gallons treated			
- Total average flow rate (gpm)			

Table 2-2
 Old Roosevelt Field Superfund Site
 Groundwater Treatment Plant
 System Alarm Summary

Date	Time	TagName	Alarm Description	Reason for System Shutdown



Table 3-1
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant
Monthly SPDES Permit Equivalent Parameter Analytical Summary

Sample Date:

Parameter	Influent				Effluent	Discharge Permit Equivalent Limit	Notes
	EW-1S	EW-1I	EW-1D	Combined Influent			
pH							
- Low	- SU	- SU	- SU	- SU	SU	SU	
- High	- SU	- SU	- SU	- SU	SU	SU	
- Average	- SU	- SU	- SU	- SU	SU	SU	
1,1-Dichloroethane	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
cis-1,2-Dichloroethylene	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
Tetrachloroethylene	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
1,1,1-Trichloroethane	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
Trichloroethylene	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
Aluminium	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	
Chromium	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
Flouride	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	
Iron	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
Lead	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
Manganese	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
Nickel	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
Sum of Iron and Manganese	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	

Note:
Refer to Appendix B for complete analytical data packages.



Table 3-2
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant
Monthly Air Permit Equivalent Parameter Analytical Summary

Sample Date

Constituent	Effluent Air Concentration (ppbv)	Molecular Weight (g/mol)	Air flow Rate (CFM)	Emmissions Rate (lb/day)	Permit Equivalent (lb/day)
Tetrachloroethene		165.82		0.00000	
Trichloroethene		131.38		0.00000	

Note:

Air flow rate is average rate for reporting period.
Refer to Appendix C for complete analytical data

Legend:

CFM - cubic feet per minute
g/mol - gram per mol
lb/day - pound per day
ppbv - part per billion vapor

Appendix A
System Run Time Log

Appendix A

[illegible]

Appendix F
Document and Records Control Forms



DOCUMENT REVIEW COMMENT ECORD

DOCUMENT

Title: _____	<input type="checkbox"/>	Final	<input type="checkbox"/>	Due Date _____
Revision No. _____	Draft			Project No. _____
				Page ____ Of ____
Issuing Group/Organization _____				
Author(s) _____				

REVIEWER

Name _____	Reviewer Signature _____
Group/Organization _____	Review Date _____

SECTION(S) / AREA(S) TO BE REVIEWED

CLOSURE

Reviewer Signature _____	Author Signature _____
Date _____	Date _____

REVIEW / DISPOSITION (Comments indexed by item No. and Attached)

ITEM NO.	SECTION / PAGE/ PARAGRAPH	AGREEMENT (REVIEWER/AUTHOR)

DOCUMENT REVIEW COMMENT RECORD
(CONTINUED)

DOCUMENT Title: _____ REVIEWER Name _____	Project No. _____ Page ____ of ____
--	--

[illegible]

[illegible]

Appendix G
Procurement Control Records

CONDITIONS OF PURCHASE ORDER

Title- Title to all materials and/or equipment purchased or supplied pursuant to this purchase order shall, contingent upon payment by vendee, vest in vendee directly upon delivery at the project site, or such location as directed, free and clear of any security interest, claim or lien of any nature.

Indemnity- To the fullest extent permitted by law, vendor shall protect, hold free and harmless, defend and indemnify vendee from all liability, cost, losses, damages, expenses, causes of action, claims or judgments (including attorney fees) resulting from bodily injury, sickness, disease, or death sustained by any person, damage to property of any kind, any alleged or actual infringement or violation of any patent or patent rights, or any breach of contract or warranty, any of which of the foregoing arise out of or is in any way connected with the performance of the obligations and the supplying of goods done under this purchase order to the extent attributable, in whole or in part, to the acts of omissions, or willful or negligent conduct of the vendor and its officers, agents and servants, or to the quality or nature of goods provided hereby. Vendor further agrees, contingent on vendee's payment in satisfaction of this order, to protect and fully indemnify the vendee against all liability for claims and liens for labor, taxes, materials, appliances, equipment and supplies whatsoever, attorney's fees. The foregoing indemnity provisions shall not be construed to negate, abridge or otherwise reduce any other rights of the parties at law or at equity.

Warranty- The supplier warrants that all materials and/or equipment furnished by him to the project shall be new unless otherwise specified, and that all such materials and/or equipment shall be of good quality, free from faults and defects and in conformance with project specifications. All materials and/or equipment not conforming to these standards may be considered defective. Such warranty shall survive delivery and shall survive delivery and shall not be deemed waived wither by reason of vendee's acceptance of materials and/or equipment or by payment for them. Such warranty shall be in addition to and not in limitation of any other warranty or remedy required by law or by the project specifications.

Termination- Should the vendor at any time refuse or neglect to supply a sufficiency of material and/or equipment of the proper quality, or fail in any respect to prosecute the performance of this purchase order with promptness and diligence or fail in the performance of any agreements contained herein, the vendee shall be at liberty after reasonable notice to the vendor to either: provide any such materials, and/or equipment and to deduct the cost thereof from any money then due or thereafter to become due to vendor under this purchase order, or, if the vendee shall deem that such refusal or neglect or failure is sufficient grounds for such actions, to terminate the purchase order.

Delivery- Vendor acknowledges and warrants that payment by vendee, under this agreement, is conditioned upon the timely delivery to the vendee of goods to fully complying with the project specifications in sound, usable, and acceptable condition. Nothing in this agreement shall by construed to create a contractual relationship between vendee and any shipper of goods hereunder. It shall be the

vendor's sole responsibility to arrange for delivery of goods without liability to the vendee. The risk of loss for materials and/or equipment covered by this purchase order, whether in a deliverable state or otherwise, shall remain with the vendor until delivered to the jobsite as herein directed, and actually received by the vendee, and any damage to the material and/or equipment or loss of any kind occasioned in transit shall be borne by the vendor notwithstanding the manner in which the goods are shipped or who pays the freight or other transportation costs. Unless otherwise provided, all materials shipped to the jobsite in performance of this contract shall be shipped prepaid. Failure to so ship and resultant claims by carriers against the vendee for said shipping costs shall result in payment by vendee for said shipping costs shall result in payment by vendee for said charges and set off against the purchase order amount.

Specifications- The vendor hereby agrees to submit or resubmit any and all shop and fabrication drawings, design and performance data, certificates, tests, samples, operating and/or maintenance manuals, schedules, color selections and descriptive product data promptly and as required by any project specifications and/or as directed by the vendee, all in sufficient quantity as to adequately provide for the needs of the vendee. Approval of any of the foregoing by the vendee shall under no circumstances alter the requirements of said specifications for quality, quantity, finish, dimension, design and configuration: nor shall such approval constitute acceptance by the vendee of any method, material or equipment not ultimately acceptable to the owner or the owner's authorized agent of the project of which they become a part; nor shall such approval or the lack thereof relieve the vendor of any of his responsibilities to the vendee pursuant to this agreement. The vendor further agrees that the cost of all designs, drawings, tests, samples, and mockups required pursuant to this agreement, together with field measurements, sampling and shipping or delivery expenses connected with any of the foregoing, shall be included in the amount of this purchase agreement. The vendor hereby agrees that the entire cost of altering, reworking, and refinishing any manufactured or fabricated items or materials provided pursuant to this purchase order and not conforming to approved designs, drawings, or samples shall be borne by the vendor.

Insurance- The vendor, upon request of the vendee, shall submit evidence of vendor's insurance coverage for general, contractual, products and automobile liability.

Lien Waivers- Before issuance of any payment, the vendor, if required, shall submit evidence satisfactory to the vendee that all bills for material and equipment and all known indebtedness connected with this purchase order have been satisfied.

Unit Prices- Unit prices listed for open quantity orders shall remain firm until the date recited on the face hereof.

Seller Initial _____

Buyer Initial _____

Appendix H

Design Control Forms



DESIGN REVIEW RECORD

DOCUMENT

Due Date _____

Project No. _____

Project Title: Old Roosevelt Field Contaminated Groundwater Area Superfund Site

Revision No. _____ ☐ Draft ☐ Final Page ____ Of ____

Issuing Group/Organization _____

Author(s) _____

REVIEWER

Name _____ Reviewer Signature _____

Group/Organization _____ Review Date _____

SECTION(S) / AREA(S) TO BE REVIEWED

CLOSURE

Reviewer Signature _____ Author Signature _____

Date _____ Date _____

REVIEW / DISPOSITION (Comments indexed by item No. and Attached)

ITEM NO.	SECTION / PAGE/ PARAGRAPH	AGREEMENT (REVIEWER/AUTHOR)

[illegible]

Appendix I
Measurement and Test Equipment Forms



By _____

Page _____ of _____

[illegible]

Appendix J
Inspection Forms

ORF Inspection Checklist

Definable Feature of Work (DFW):	Date:			Subcontract No:
	Time:			
Item	Yes	No	NA	Remarks
Have pertinent subcontract requirements and work plans been explained to project personnel (e.g. technical specifications)?				
Have required control inspections, sampling, and field measurement / test requirements been explained to project personnel?				
Have project documentation and recordkeeping requirements been explained to project personnel (e.g. project forms, logs, photographs, records)?				
Have all necessary subcontracts and purchase orders been established?				
Have all applicable permits, licenses, and certifications been identified or obtained?				
Have project planning documents been reviewed and approved by CDM?				
Are required materials, supplies, and equipment on-hand, available, in working order, and are in accordance with approved plans/shop drawings and contract specifications?				
Has all front-end and site layout work been completed in preparation for commencing the DFW?				
Have the requirements of the EPP been explained to project personnel?				
Have the requirements of the SSHP been explained to project personnel?				
Have the requirements of the SAMP/QAPP been explained to project personnel?				
Notes:				



Sheet _____ of _____

ORF Inspection Checklist				
Definable Feature of Work (DFW):	Date:		Subcontract No:	
	Time:			
Inspection Type (circle one): Initial Follow-Up				
Item	Yes	No	NA	Remarks
Is the work being performed in accordance with the applicable section(s) of the subcontract specifications?				
Is the work being performed in accordance with approved design/shop drawings and contract specifications?				
Is the work being performed in accordance with approved work plans (e.g. CQCP, EPP, SAMP/QAPP)?				
Is the work being performed cautiously and with acceptable levels of workmanship?				
Is equipment being operated properly?				
Is the work being performed using proper methods and procedures?				
Have any defective or damaged materials been identified?				
Are results of applicable tests, samples, and/or measurements within acceptable levels?				
Is the work being performed in a safe manner and in accordance with the SSHP?				
Have pertinent records been completed or collected?				
Have any nonconformances been identified, corrected, and re-inspected?				
Notes:				

Appendix K
Nonconformance and Corrective Action Forms



Nonconformance Report

Old Roosevelt Field	Subcontract No.	NCR No.:
Site Location: Garden City, NY	Date:	WAD:

Description of Nonconformance:

Prepared by:

Quality Control Representative

Date:

Reviewed by:

Contractor Quality Control Manager

Date:

Disposition:

Recommended by:

Date:

Reviewed by:

Quality Control Representative

Date:

Corrective Action Verification:

Implemented by:

Date:

Verified by:

Quality Control Representative

Date:

Nonconformance Closeout:

Contractor Quality Control Manager

Date:



CORRECTIVE ACTION REQUEST

ADVERSE TREND: Yes <input type="checkbox"/> No <input type="checkbox"/>		CAR Number:		Date:
Organization/Project/Department:			Person contacted:	
Discrepancy (includes Specific Requirements Violated): 				
Originator:		Response Due Date:		
Corrective Action Taken/Proposed to Correct Discrepancy: 				
Corrective Action Taken to Prevent Reoccurrence (the cause of the discrepancy must also be included here): 				
Corrective Action Taken by (signature and title):		Date When Corrective Action will be Completed:		
Corrective Action Evaluated		Verification of Implementation: 		
Evaluated By:	Date:	Verified By:	Date:	



STOP WORK ORDER

Subcontract No. _____

Project No. _____

Task Order No. _____

SWO NO.: _____ STOP WORK ORDER _____ PAGE ____ OF ____

1. Written Notice Issued To:

2. P.O. # or Activity:

4. Issued By:

Name : _____

Name: _____

Title : _____

3. Location:

Org. : _____

Title: _____

5. Verbal Notice Issued To:

Name: _____ Title: _____ Date: _____ Time: _____ am
pm

6. Associated NCR's YES ___ NO ___

Report No. _____

7. Associated C.A.R. :

Yes ___ No ___ Request No. _____

8. Description of Stop Work Order Condition:

attachment ____

9. Remedial Action Required:

attachment ____

By Whom: _____ By When: _____

Required Remedial Action Determined By:

Project Manager: _____

Date: _____

Quality Control Manager: _____

Date: _____

Engineering Manager: _____

Date: _____

10. Follow-Up of Remedial Action Taken:

attachment ____

Verbal Notice To Resume Operations Given To:

Name: _____ Title: _____ Date: _____ Time: _____ am
pm

Stop Work Order Cancellation Authorized By:

Quality Control Manager: _____ Date: _____

Appendix L
Change Control Forms



Field Work Variance		
Variance Number:	Project Number:	Date:
Present Requirements:		
Proposed Change:		
Technical Justification:		
Cost/Schedule Impact:		
Reason for Change: Addition _____ Deletion _____		
Change Order Required: Yes _____ No _____ Change Order Number: _____		
Requested By:		Date:
Applicable Document: None		
CC: Distribution		
Approved By: _____ Arrowhead Project Manager		Date: _____
Approved By: _____ Arrowhead Quality Control Manager		Date: _____
Approved By: _____ CDM Site Lead		Date: _____
Approved By: _____ CDM Project Manager		Date: _____
Approved By: _____ CDM Contracting Officer's Representative		Date: _____

Appendix M
Subcontractor Control Forms



SUBCONTRACTOR DAILY TRACKING LOG

Contractor: _____

Description of Work Performed/Location:

Manpower:

Name	Trade	Hours

Equipment:

Materials:

Subcontractor Representative: _____ Date: _____

Printed Name/Title: _____

Arrowhead Management Approval: _____ Date: _____

Printed Name/Title: _____

Appendix N
Material Receipt Inspection Forms



RECEIPT INSPECTION

Contractor: Arrowhead Contracting, Inc.
Subcontract No. _____
Project Name/No. _____
Vendor Name _____
Item Name or Description _____

Report No. _____
Task Order _____
P.O. No. _____

Y - YES; N - NO (SEE REMARKS); NA - NOT APPLICABLE	
Item conforms to the Buy American Act Requirements	
Procurement documents were reviewed and used for inspection	
Required supporting documentation has been received (i.e., MSDS, certifications)	
Item numbers/volume corresponds to those identified on procurement documents	
Item is visually free of defects or damage	
Item meets task order specification	
Is item acceptable for release	

REMARKS:

Receipt Inspector

Date

Site QCM

Date

Appendix O
Project Submittal Register

Old Roosevelt Field Superfund Site
Transmittal Register

TITLE AND LOCATION		Roosevelt Field																	ACI SCHEDULE DATES			ACI ACTION		CDM ACTION		
N A S A c t i v i t y C o d e	I t e m N u m b e r	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL										Classification		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	DATE	SUBMITTED BY	DATE	REMARKS				
				P r e c o n s t S u b m i t t a l	S h o p D r a w i n g s	P r o d u c t D a t a	D e s i g n D a t a	T e s t R e p o r t s	C e r t i f i c a t e s	M F R S I n s t r u c t i o n s	M F R S F i e l d R e p o r t s	O & M D a t a	C l o s e o u t S u b m i t t a l	E n g i n e e r A p p r o v e d	R e v i e w e r											
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
		01010	Summary of Work																							
		01201	Pre-Construction and Pre-Work Conferences																							
		01201-1.5.1	Conference Meeting Minutes			x									x											
		01202	Project Progress Meetings																							
		01202-1.3.1	Project Progress Meeting Minutes			x									x											
		01270	Measurement and Payment																							
		01310	Administrative Requirements																							
		01310-1.2.1	Project Organizational Chart			x									x											
		01310-1.2.2	Project Manager Name and Experience			x									x											
		01320	Project Schedules																							
		01320-1.3.1	Initial Project Schedule			x									x											
		01320-1.3.2	Revised Project Schedule			x									x											
		01330	Submittals Procedures																							
		01351	Safety, Health, and Emergency Response																							
		01351-1.3.1	Site Safety and Health Plan			x									x											
		01351-1.3.2	Weekly Safety and Accident Reports				x								x											
		01351-1.3.3	Air Monitoring Data				x								x											
		01351-1.3.4	Personnel Health and Safety Certificates						x						x											
		01351-1.3.2	Safety and Health Manager Statements						x						x											
		01351-1.3.6	Certificate of Worker/Visitor Acknowledgement						x						x											
		01351-1.3.4	Project Safety and Health Phase-Out Report										x	x												
		01355	Environmental Protection																							
		01355-1.3.1	Environmental Protection Plan			x									x											
		01380	Project Photographs																							
		01380-1.2.1	Project Photographs				x								x											
		01450	Chemical Data Quality Control																							
		01450-1.3.1	Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP)			x									x											
		01450-1.3.2	ANSETS Data Requirement Form and Trip Report						x						x											
		01450-1.3.3	Topsoil Material Testing Results						x						x											
		01450-1.3.4	Analytical Data						x						x											
		01450-1.3.5	Non-Conformance Reports						x						x											
		01450-1.3.6	Chemical Data Final Report (CDFR)						x						x											
		01451	Contractor Quality Control																							
		01451-1.3.1	CQC Plan			x									x											
		01451-1.3.2	CQC Organizational Changes				x								x											
		01541-1.3.3	CQC Reports				x								x											
		01500	Temporary Construction Facilities and Utilities																							
		01500-1.2.1	Temporary Site Facility Layout Plan			x									x											
		01550	Surveying																							
		01550-1.2.1	Surveyor Qualifications				x								x											
		01550-1.2.2	Surveyor Accuracy Documentation				x								x											
		01550-1.2.3	Surveyor Field Notes				x								x											

Old Roosevelt Field Superfund Site
Transmittal Register

TITLE AND LOCATION				Roosevelt Field																											
N A S A c t i v i t y C o d e	I t e m N u m b e r	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL												Classification		ACI SCHEDULE DATES			ACI ACTION			CDM ACTION							
				P r e c o n s t S u b m i t t a l	S h o p D r a w i n g s	P r o d u c t D a t a	S a m p l e s D a t a	D e s i g n D a t a	T e s t R e p o r t s	C e r t i f i c a t e s	M F R S I n s t r u c t i o n s	M F R S F i e l d R e p o r t s	O & M D a t a	C l o s e o u t S u b m i t t a l	I n f o r m a t i o n O n l y	E n g i n e e r A p p r o v e d	R e v i e w e r	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	C O D E	DATE	SUBMITTED BY	C O D E	DATE	REMARKS					
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.					
		01550-1.2.4	As-Built Drawings											X		X															

Old Roosevelt Field Superfund Site
Transmittal Register

TITLE AND LOCATION		Roosevelt Field																									
N A S A c t i v i t y C o d e	I t e m N u m b e r	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL										Classification		ACI SCHEDULE DATES			ACI ACTION		CDM ACTION		CODE	CODE	CODE	REMARKS	
				P r e c o n s t S u b m i t t a l	S h o p D r a w i n g s	P r o d u c t D a t a	D e s i g n D a t a	T e s t R e p o r t s	C e r t i f i c a t e s	M F R S I n s t r u c t i o n s	M F R S F i e l d R e p o r t s	O & M D a t a	C l o s e o u t S u b m i t t a l	I n f o r m a t i o n O n l y	E n g i n e e r A p p r o v e d	R e v i e w e r	S U B M I T	A P P R O V A L N E E D E D B Y	M A T E R I A L N E E D E D B Y	D A T E	S U B M I T T E D B Y	D A T E	R E M A R K S				
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.	
		01680	Signs																								
		01720	Project Record Documents																								
		01780	Project Closeout																								
		01780-1.3.1	Interim Remedial Action (RA) Report										x		x												
		01800	Treatment System Operation and Maintenance																								
		01800-1.2.1	Notification of Maintenance Activities										x		x												
		01800-1.2.2	Monthly Operating Logs										x		x												
		01800-1.2.3	Initial Testing Program (ITP) Report					x							x												
		01800-1.2.4	Quarterly Remedial Progress Reports					x							x												
		01800-1.2.5	Computerized Recordkeeping System										x		x												
		01800-1.2.6	Optimization Report					x							x												
		01850	Facility System Operations and maintenance Manual and Startup Training																								
		01850-1.3.1	Systems O&M Manual										x		x												
		01850-1.3.2	User Startup Training and Instruction Schedule	x											x												
		01850-1.3.3	Proposed Changes to the O&M Manual										x		x												
		01851	Well Maintenance Program																								
		01851-1.2.1	Chemical Additives and Agents			x									x												
		01851-1.2.2	Extraction Well Testing Results					x							x												
		02100	Site Preparation																								
		02100-1.3.1	Site Preparation Plan	x											x												
		02100-1.3.2	Crushed Stone Aggregate Certificates of Compliance						x						x												
		02100-1.3.3	Geotextile Filter Fabric Certificates of Compliance						x						x												
		02100-1.3.4	Permits						x						x												
		02120	Offsite Transportation and Disposal																								
		02120-1.3.1	Transportation Plan	x											x												
		02120-1.3.2	Notice of non-Compliance and Notice of Violation			x									x												
		02120-1.3.3	Transport Certification						x						x												
		02120-1.3.4	Annual and Biennial Reports						x						x												
		02120-1.3.5	Shipping Documents and Packaging Certification							x					x												
		02120-1.3.6	EPA Off-Site Policy						x						x												
		02120-1.3.7	Certificates of Disposal						x						x												
		02120-1.3.8	Disposal Facility Names and Permits	x											x												
		02300	Earthwork																								
		02300-1.3.1	Excavation, Trenching, and Backfill Plan	x											x												
		02300-1.3.2	Laboratory and Field Test Results						x						x												
		02300-1.3.3	Earthen Materials Certificates of Compliance							x					x												
		02370	Soil Erosion Control																								
		02370-1.3.1	Soil Erosion and Sediment Control Plan	x											x												
		02370-1.3.2	Samples				x								x												
		02370-1.3.3	Permits						x						x												

Old Roosevelt Field Superfund Site
Transmittal Register

TITLE AND LOCATION		Roosevelt Field																ACI SCHEDULE DATES				ACI ACTION		CDM ACTION		
N A S A c t i v i t y C o d e	I t e m N u m b e r	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL												Classification		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	C O D E	DATE	SUBMITTED BY	C O D E	DATE	REMARKS
				P r e c o n s t S u b m i t t a l	S h o p D r a w i n g s	P r o d u c t D a t a	S a m p l e s	D e s i g n D a t a	T e s t R e p o r t s	C e r t i f i c a t e s	M F R S I n s t r u c t i o n s	M F R S F i e l d R e p o r t s	O & M D a t a	C l o s e o u t S u b m i t t a l	I n f o r m a t i o n O n l y	E n g i n e e r A p p r o v e d	R e v i e w e r									
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
		02510	Water Service Line																							
		02510-1.3.1	Valves		x											x										
		02510-1.3.2	Material List			x										x										
		02510-1.3.3	Satisfactory Installation			x										x										
		02510-1.3.4	Certificates of Compliance							x						x										
		02510-1.3.5	Hydrostatic Testing and Disinfection						x							x										
		02510-1.3.6	Installation Instructions								x					x										
		02576	Pavement																							
		02576-1.3.1	Certified Mix Designs	x												x										
		02576-1.3.2	Certified Test Results for Gravel Gradation					x								x										
		02821	Fencing																							
		02821-1.3.1	Fencing		x											x										
		02821-1.3.2	Material Certificates							x						x										
		02900	Site Restoration																							
		02900-1.3.1	Material Certificates							x						x										
		03100	Concrete Formwork																							
		03100-1.3.1	Detail Drawings		x											x										
		03100-1.3.2	Form Design			x										x										
		03100-1.3.3	Form Materials			x										x										
		03100-1.3.4	Form Releasing Agents				x									x										
		03100-1.3.5	Form Releasing Agents								x					x										
		03100-1.3.6	Certificates							x						x										
		03150	Concrete Joints and Joint Accessories																							
		03150-1.3.1	Product Data			x										x										
		03150-1.3.2	Certifications							x						x										
		03200	Concrete Reinforcement																							
		03200-1.3.1	Reinforcing Steel Shop Drawings		x											x										
		03200-1.3.2	Mill Test Reports							x						x										
		03200-1.3.3	Welder's Certification							x						x										
		03300	Cast-in-Place Concrete																							
		03300-1.3.1	Mixture Proportions			x										x										
		03300-1.3.2	Testing and Inspection for Contractor Quality Control							x						x										
		03300-1.3.3	Qualifications, Manufacturer's Certification							x						x										
		03410	Precast Concrete Structures																							
		03410-1.3.1	Shop Drawings		x											x										
		03410-1.3.2	Design Data							x						x										
		03410-1.3.3	Test Reports							x						x										
		03410-1.3.4	Material Certificates								x					x										
		03410-1.3.5	Compliance Certificates							x						x										
		11319	Submersible Well Pump																							
		11319-1.3.1	Pump Selection Calculations and Performance Data		x											x										
		11319-1.3.2	Manufacturer's Installation Instructions								x					x										
		11319-1.3.3	Manufacturer's Descriptive Data			x										x										
		11319-1.3.4	Technical Literature			x										x										
		11319-1.3.5	Manufacturer's Certified Pump Curve			x										x										
		11319-1.3.6	Corrosion Protection Certificate							x						x										

Old Roosevelt Field Superfund Site
Transmittal Register

TITLE AND LOCATION		Roosevelt Field																	ACI SCHEDULE DATES			ACI ACTION		CDM ACTION		
N A S A c t i v i t y C o d e	I t e m N u m b e r	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL												Classification		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	DATE	SUBMITTED BY	DATE	REMARKS		
				P r e c o n s t S u b m i t t a l	S h o p D r a w i n g s	P r o d u c t D a t a	D e s i g n D a t a	T e s t R e p o r t s	C e r t i f i c a t e s	M F R S I n s t r u c t i o n s	M F R S F i e l d R e p o r t s	O & M D a t a	C l i n i c o u t S u b m i t t a l	I n f o r m a t i o n O n l y	E n g i n e e r A p p r o v e d	R e v i e w e r										
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
		11319-1.3.7	O&M Manual																							
		13122	Groundwater Treatment Building																							
		13122-1.2.1	Building Layout Drawings	x																						
		13122-1.2.2	Structural Drawings and Specifications	x																						
		13122-1.2.3	HVAC, Plumbing, and Fire Protection Drawings and Specifications	x																						
		13122-1.2.4	Shop Drawings		x																					
		13122-1.2.5	Color Samples				x																			
		13122-1.2.6	P.E. Certification							x																
		13122-1.2.7	Erection Drawings		x																					
		13122-1.2.8	Manufacturer's Certifications							x																
		13122-1.2.9	Warranty							x																
		13122-1.2.10	Sanitary Waste Holding Tank Permit							x																
		TABLE 9-2	Security System/HVAC/Misc. Bldg Function							x																
		13300	Groundwater Treatment System																							
		13300-1.2.1	Pilot Testing Plan	x																						
		13300-1.2.2	Groundwater Treatment Plan	x																						
		13300-1.2.2.1	Groundwater Treatment Equipment			x																				
		13300-1.2.2.2	Process Flow and Instrumentation Diagrams		x																					
		13300-1.2.2.3	Plan and Cross-Sections/ View of Treatment Layout		x																					
		13300-1.2.5	Equipment Certificates							x																
		13300-1.2.6	Calculations					x																		
		13300-1.2.7	Test Reports						x																	
		13300-1.2.8	Warranty							x																
		13300-1.2.9	Hardware and Software Design							x																
		13400	Process Instrumentation and Controls - Product																							
			To be developed as design is completed						x																	
		13410	Supervisory Control and Data Acquisition System																							
			To be developed as design is completed						x																	
		15200	Piping, Valves, and Appurtenances																							
		15200-1.3.1	Shop Drawings		x																					
		15200-1.3.2	Product Data			x																				
		15200-1.3.3	Statements of Satisfactory Installation and Thrust Restraint Methods						x																	
		15200-1.3.4	Equipment Samples as Appropriate				x																			
		15200-1.3.5	Design Data and Assumptions					x																		
		15200-1.3.6	Certified Shop Tests							x																
		15200-1.3.7	Performance Testing								x															
		15200-1.3.8	Certifications							x																
		15200-1.3.9	Manufacturer's Certification							x																
		15200-1.3.10	Equipment/System Warranty							x																
		16000	Electrical - General Provisions																							
		16000-1.3.1	Shop Drawings		x																					
		16000-1.3.2	Manufacturer's Product Information			x																				
		16000-1.3.3	Electrical Installation Drawings		x																					

Old Roosevelt Field Superfund Site
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Old Roosevelt Field Superfund Site
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				P r e c o n s t S u b m i t t a l	S h o p D r a w i n g s	P r o d u c t D a t a	S a m p l e s	D e s i g n D a t a	T e s t R e p o r t s	C e r t i f i c a t e s	M F R S I n s t r u c t i o n s	M F R S F i e l d R e p o r t s	O & M D a t a	C l o s e o u t S u b m i t t a l	E n g i n e e r A p p r o v e d O n l y											
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
		16110	Receivers, Boxes, Fittings and Supports																							
		16110-1.2.1	Product Data			X									X											
		16110-1.2.2	Samples				X								X											
		16141	Wiring Devices																							
		16191	Miscellaneous Electrical Equipment																							
		16191-1.2.1	Catalog Information			X									X											
		16220	Motors																							
		16220-1.3.1	Motor Data			X									X											
		16220-1.3.2	Dimension Drawings		X										X											
		16620-1.3.3	Equipment Guarantee							X					X											
		16620-1.3.4	Equipment Warranty							X					X											
		TABLE 9-2	Motor Rotation/Phase balance at each 3 phase motor							X																
		16261	Variable Frequency Drive Systems Under 300 Volts																							
		16261-1.3.1	Shop Drawings		X										X											
		16261-1.3.2	Equipment Data			X									X											
		16261-1.3.3	Test Reports						X						X											
		16261-1.3.4	Manufacturer's Instructions							X					X											
		16261-1.3.5	Manufacturer's Field Reports								X				X											
		16261-1.3.6	Equipment Warranty							X					X											
		16375	Electrical Distribution System, Underground																							
		16375-1.4.1	Manufacturer's Catalog Data			X									X											
		16375-1.4.2	Material, Equipment, and Fixtures List			X									X											
		16375-1.4.3	Electrical Distribution System Drawings		X										X											
		16375-1.4.4	Factory Test						X						X											
		16375-1.4.5	Field Testing Plan						X						X											
		16375-1.4.6	Test Reports						X						X											
		16375-1.4.7	Materials and Equipment Certificates							X					X											
		16402	Electrical Work, Interior																							
		16402-1.3.1	Manufacturer's Catalog Data			X									X											
		16402-1.3.2	Material, Equipment, and Fixtures Lists			X									X											
		16402-1.3.3	Installation Procedures			X									X											
		16402-1.3.4	Interior Electrical Equipment Drawings		X										X											
		16402-1.3.5	Structural Drawings		X										X											
		16402-1.3.6	Electrical Drawings		X										X											
		16402-1.3.7	Onsite Test						X						X											
		16402-1.3.8	Factory Test Reports						X						X											
		16402-1.3.9	Field Test Plan						X						X											
		16402-1.3.10	Field Test Reports						X						X											
		16402-1.3.11	Materials and Equipment Certificates							X					X											
		16470	Panelboards																							
		16502	Lighting Protection System																							
		16502-1.3.1	Lighting Protection System		X										X											
		16502-1.3.2	Lighting Protection System				X								X											

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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.	z.	aa.
		16600	Underground System																							
		16600-1.4.1	Shop Drawings		X										X											
		16600-1.4.2	Product Data			X									X											
		TABLE 9-2	Ground Testing					X																		
		16660	Grounding System																							
		16660-1.3.1	Shop Drawings		X										X											
		16660-1.3.2	Product Data			X									X											
		16660-1.3.3	Test Results					X							X											
		16721	Telephone System																							
		16742	High Speed Broadband System																							
		16742-1.4.1	Shop Drawings		X										X											
		16742-1.4.2	Spare Parts			X									X											
		16742-1.4.3	Manufacturer's Recommendations								X				X											
		16742-1.4.4	Test Plan								X				X											
		16742-1.4.5	Qualifications	X											X											
		16742-1.4.6	Test Reports					X							X											
		16742-1.4.7	Materials and Equipment						X						X											
		16742-1.4.8	Operations and Maintenance Data										X		X											

**ENVIRONMENTAL PROTECTION PLAN
REMEDIAL CONSTRUCTION ACTIVITIES
OLD ROOSEVELT FIELD CONTAMINATED GROUNDWATER AREA SUPERFUND SITE
GARDEN CITY, NEW YORK**

SUBCONTRACT NO. 3320-023-001-CN-S

Submitted to:

**CDM Federal Programs Corporation
110 Fieldcrest Ave., 6th Floor
Edison, New York 08837**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher
Lenexa, Kansas 66219**

March 2011

Revision 2

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List of Acronyms

Arrowhead	Arrowhead Contracting, Inc.
CFR	Code of Federal Regulation
CDM	CDM Federal Programs Corp.
CVOC	chlorinated volatile organic compound
CY	Cubic Yard
DCE	Dichloroethene
DOT	Department of Transportation
EPP	Environmental Protection Plan
GAC	granular activated carbon
MSDS	Material Safety Data Sheet
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
O&M	operations and maintenance
PCE	tetrachloroethene
PEL	Permissible Exposure Limit
PID	photoionization detector
PPE	personal protective equipment
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SSHP	Site Safety and Health Plan
SSHO	Site Safety and Health Officer
TCE	trichlorethene
TCLP	Toxicity Characteristic Leaching Procedure
VOC	volatile organic compound

1.0 Introduction

This document constitutes the Environmental Protection Plan (EPP) for field activities associated with the Remedial Construction at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site (Site), Garden City, New York. This document was prepared for CDM Federal Programs Corporation (CDM) under Subcontract No. 3320-023-001-CNS. This EPP covers field activities conducted by Arrowhead Contracting, Inc. (Arrowhead) and its subcontractors in accordance with the subcontract scope of work. The purpose of the EPP is to present the control measures that will be implemented to ensure that field activities conducted by Arrowhead do not adversely impact the soil, water, and air. This document has been prepared in accordance with the following subcontract specifications:

- Section 01355 (Environmental Protection)
- Section 02370 (Soil Erosion Control), including the requirements for an Environmental Protection and Spill Control Plan and Soil Erosion and Sediment Control Plan, which has been submitted to the Nassau County Soil Water Conservation District
- Section 02120 (Offsite Transportation and Disposal), including the requirements for a Waste Management Plan

1.1 Site Description

The site is located in the Village of Garden City, Nassau County, New York. The Site is located on the eastern side of Clinton Road, approximately 0.6 mile south of the intersection with Old Country Road. The Site includes a thin strip of open space along Clinton Road (known as Hazalhurst Park), a large retail shopping mall with a number of restaurants, and a movie theater. Several office buildings (including Garden City Plaza) share parking space with the shopping mall.

Two municipal water supply well fields are located south (downgradient) of the Site. The Village of Garden City public water supply wells (designated as GWP-10 and GWP-11) are located just south of the Site boundary, on the eastern side of Clinton Road. The Hempstead well field is located approximately 1.5 miles south of the Garden City supply wells. Two stormwater recharge basins are directly east and south of the mall area. The eastern basin, Pembroke, is

located on the property owned by the mall. The basin to the south is Nassau County Recharge Basin number 124.

Groundwater at the Site is contaminated with volatile organic compounds (VOCs), particularly chlorinated VOCs such as tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and 1,1-dichloroethene (1,1-DCE). The highest levels of PCE and TCE detected in groundwater are 300 and 960 ug/l, respectively. The remedy, as defined in the September 2007 Record of Decision (ROD, involves groundwater extraction and ex-situ treatment (pump and treat) in order to expedite the restoration of water quality in the aquifer in comparison with natural processes alone, and provide for vapor intrusion mitigation, if deemed necessary.

1.2 Field Activities

The goal of this project is to perform remedial construction activities associated with the construction of a groundwater treatment plant. The project will also involve Operations and Maintenance (O&M) of a groundwater treatment plant once construction is completed. Arrowhead's scope of work includes the following activities:

- Mobilization
- Preparation of design documents
- Site preparation, including set-up of work zones and support areas, and laydown area (i.e. for equipment/vehicle/materials storage), and utility location
- Site utility installation
- Installation of yard piping and well head construction
- Construction of treatment building
- Site cleanup/demobilization from construction phase
- O&M

1.3 Environmental Impacts

Potential impacts to the environment from construction activities may occur as a result of the following:

- Erosion and runoff from areas where soil is excavated or the ground surface is otherwise disturbed

- Generation, storage, and disposal of solid wastes, including municipal trash, clearing and grubbing debris, and surplus soil
- Dust emissions from construction activities
- Noise from construction and treatment system operations
- Potential spills from refueling small equipment
- Potential release of contaminated groundwater from the influent transmission lines

The remainder of this EPP addresses each of these potential sources of environmental impact.

A Phase 1B Cultural Resources Survey was completed of the construction area of the Site by Richard Grubb & Associates, Inc (October 2010) and no significant historic or prehistoric cultural resources were identified. Since impacts to historical, archeological, and cultural resources are not anticipated, these topics are not addressed in this plan.

Please note that site soils are considered to be not contaminated with respect to VOCs because they are located above the water table and are not in direct contact with contaminated groundwater.

1.4 Applicable Requirements

Activities completed at the Site will meet all substantive requirements for environmental protection. The following is a general description of applicable requirements.

- **Wastewater** – Waste water will not be pumped from excavations but instead will be allowed to soak into the soil below the excavation. The subsoil in the area is clean sand, therefore, Arrowhead anticipates that the soil will easily allow water to infiltrate. A review of the United States Department of Agriculture Soil Conservation Service maps for the area indicates that the soil is very permeable sand and gravel outwash. The soil at a depth of 33 to 60 inches bgs has a permeability of more than 20 inches per hour.

Wastewater generated as the result of the equipment decontamination process will also be containerized and sampled to determine the appropriate means of disposal.

- **Air** – Off-gas from the air stripper will be discharged directly to atmosphere without treatment. Air samples will be collected and analyzed using EPA Method TO-15 to verify

compliance with air discharge criteria. Refer to the Quality Assurance Project Plan (QAPP) for additional discussion related to analytical testing requirements.

Although not anticipated, VOC emissions that may be generated as a result of general excavation activities will be monitored to ensure the protection of field personnel and the public. Control measures will be implemented as necessary to ensure compliance with OSHA permissible exposure limits (PELs). Furthermore, site personnel will visually monitor ambient dust levels during construction. When visible dust emissions become noticeably elevated, dust suppression methods will be implemented immediately. Refer to Section 2.0 for additional detail.

- **Solid Waste** – As previously discussed, it is anticipated that soil generated during all excavations will not be contaminated. This soil will be used as non-structural backfill material in the trench or surrounding the building foundation excavation as part of finish grading. Soil will be placed and compacted in accordance with Specification Section 02300.

Excess soil that is not needed as backfill material will be disposed off-site. The soil will be sampled and analyzed in accordance with QAPP Worksheet #17a to characterize and profile the waste for subsequent disposal. The sampling requirements (number of samples and analytical methods required) will be provided by the disposal facility based upon their permit requirements. As required, the permitting, waste profiling manifests, and packaging requirements of receiving disposal facilities will be followed.

All non-hazardous solid wastes, such as municipal trash and clean construction debris, will be transported to a local transfer station for disposal at a licensed facility. This waste will be disposed without any sampling requirements.

- **Erosion** –Erosion control measures will be implemented during construction in accordance with Clean Water Act best management practices and Section 02370 of the subcontract specifications and the project Soil Erosion and Sediment Control Plan. Refer to Section 3.0 for additional detail.
- **Noise** – Local noise ordinances will be observed. All construction equipment will be fitted with mufflers and machine operation will be kept to a minimum.

1.5 Responsibilities

The Project Manager has the ultimate responsibility for environmental compliance and protection. The Project Manager's responsibilities include ensuring that all activities are planned in accordance with applicable requirements (refer to Section 1.4) and that the necessary oversight, personnel, equipment, subcontractors, and services are made available. The Site Supervisor and Site Health and Safety Officer (SSHO) will assist the Project Manager by enforcing the requirements of site-specific plans and procedures, including this EPP. The Site Supervisor will also have responsibility for day-to-day environmental protection activities, such as dust control, erosion and sediment control, spill cleanup (as necessary), and waste management.

2.0 Air Pollution and Dust Control

This section discusses the procedures for ensuring the protection of air quality during the project.

2.1 VOCs

Real-time, ambient VOC levels will be monitored during the construction phase of the project using a photoionization detector (PID) equipped with an 11.7 eV ionization lamp. Monitoring will be conducted within the breathing zone of personnel during the field activities involving excavation. If breathing zone VOC levels exceed the actions level as specified in the Site Safety and Health Plan (SSHP), the level of PPE will be upgraded to include respiratory protection. Based on the results of real-time breathing zone monitoring, additional VOC monitoring may be conducted at the site perimeter or at off-site locations to evaluate public exposure potential. The SSHP presents further details associated with real-time VOC monitoring.

Off-gas from the air stripper will be discharged directly to atmosphere without treatment. Modeling has shown that VOC concentrations are below NYSDEC regulatory levels and do not require treatment. Air samples will be collected and analyzed using EPA Method TO-15, in accordance with the Quality Assurance Project Plan (QAPP).

2.2 Dust

Releases of dust may occur from trenching, pavement demolition, building construction, site work, truck loading/unloading, and off-hour wind entrainment. The generation of dust and fugitive emissions shall be prevented whenever possible and controlled when necessary. Work practices shall be adjusted in a manner to minimize dust generation. To control dust emissions, both operational and administrative controls will be implemented. The adequacy of dust control will be monitored by visual inspection.

Operational Controls

The operational controls that may be implemented include:

- Minimizing material free-fall from excavation equipment (e.g., loaders and excavators) and removing all soil from exterior surfaces of haul trucks
- Following proper decontamination protocols for equipment entering and leaving the site (refer to SSHP)
- Staging trucks for loading on pavement rather than soil, to the extent possible
- Covering and securing loads on haul trucks using tarps
- Water spraying exposed soil during excavation, taking care to avoid overspraying
- Water spraying loads when transporting materials, taking care to avoid overspraying
- Water spraying piles of soil, sand, and gravel
- Covering piles of soil, sand, and gravel with plastic sheeting
- Using paved streets and roads when available
- Water spraying haul routes

Administrative Controls.

Administrative controls that may be implemented include the following:

- Maintaining speed limits on roads
- Visually monitoring ambient dust levels (refer to SSHP)
- Stopping or restricting work activities when dust levels become elevated or when the wind speed is excessive

3.0 Erosion and Sediment Control

Erosion and sediment control measures will be implemented to minimize the transport of sediment off-site and into storm water outfalls. The Site Supervisor will select the appropriate methods for erosion and sediment control consistent with actual conditions observed in the field, including topography, drainage features, locations of storm drains, storm water runoff patterns, and sediment content of storm water run off. All soil erosion and sediment control shall be performed in accordance with Section 02370. Refer to the Soil Erosion and Sediment Control plan for a discussion of means and methods for erosion control.

4.0 Noise Control

Sources of noise at the project site include the operation of heavy construction equipment, drilling operations, and treatment system operations (inside the building). In lieu of real-time noise monitoring, hearing protection will be required during the aforementioned activities and during other activities/operations, based on the discretion of the SSHO. Arrowhead will perform noise dosimetry if it is deemed necessary by the Arrowhead Designated Safety Coordinator, the CDM Site Supervisor, or if there are noise complaints from third parties. Since Arrowhead does not anticipate using any excessively loud equipment, it is unlikely that noise dosimetry will be required.

5.0 Waste Management and Disposal

Wastes generated during the project will be handled and disposed in accordance with Section 02120 of the contract specifications. Anticipated waste streams include:

- Non-hazardous, municipal solid wastes from clean construction work and site administration activities
- Non-reusable sampling equipment and PPE
- Incidental materials (used oil and oily rags) from equipment maintenance activities
- Clearing and grubbing debris
- Surplus soil from pipe trenches, foundation excavation, and site preparation
- Wastewater collected from excavations
- Wastewater from the decontamination of excavation equipment and sampling equipment and other equipment that makes contact with potentially contaminated groundwater

The following subsections discuss the management and disposal of these waste streams to ensure compliance with local and federal regulations.

5.1 On-site Waste Management

The following paragraphs discuss the on-site management of each of the solid and liquid waste streams listed above.

Non-Hazardous, Municipal Waste

Non-hazardous construction waste and refuse will be placed into a municipal trash receptacle or roll-off container (20- or 30-CY) staged within the site boundaries. Full containers will be provided and transported by a local waste hauling/disposal vendor. Full containers will be transported to a local landfill for disposal (refer to Section 5.2).

Non-Reusable Sampling Equipment and PPE

Non-reusable sampling equipment, PPE, and protective clothing will be handled and disposed as non-hazardous waste as discussed above.

Surplus Soils from Clean Construction Work

To the maximum extent possible, surplus soil from clean construction activities will be used onsite as common fill. Surplus soils from clean construction activities requiring off-site disposal will be temporarily stockpiled and covered with plastic sheeting. As previously discussed, the

excess stockpiled soil will be sampled and analyzed for waste characterization purposes. Soil classified as non-hazardous will be disposed at the Soil Safe Logan, New Jersey landfill. All surplus soil waste shipments will be accompanied by required shipping documents.

Clearing and Grubbing Debris

Clearing and grubbing debris will be transported offsite for mulching and reuse.

Waste water Collected from Excavations

Waste water will not be pumped from excavations but instead will be allowed to soak into the soil below the excavation. The subsoil in the area is clean sand, therefore, Arrowhead anticipates that the soil will easily allow water to infiltrate. A review of the United States Department of Agriculture Soil Conservation Service maps for the area indicates that the soil is very permeable sand and gravel outwash. The soil at a depth of 33 to 60 inches bgs has a permeability of more than 20 inches per hour.

Wastewater from Equipment Decontamination

If suspected contaminated soil is encountered (as determined from field screening), heavy equipment contacting contaminants will be decontaminated by spraying with a low volume, high-pressure (or steam) washer. Rinse water will be containerized and sampled to determine the appropriate disposal method. Contaminated wastewater will not be discharged to the ground surface.

5.2 Off-Site Transportation and Disposal

All wastes requiring off-site disposal will be transported by licensed haulers and disposed at approved facilities.

Non-Hazardous Solid Waste

Non-hazardous waste streams, such as municipal trash, construction debris, and other non-hazardous debris, will be transported to a local transfer station for disposal at a licensed facility.

Hazardous Waste and Special Waste

In the event a waste requiring disposal at a facility permitted to accept non-hazardous or hazardous waste is generated, Mattiola Services will be subcontracted for transportation and disposal. It is also possible that one or more of the waste streams may be classified as "special waste," defined as a non-RCRA hazardous waste that is not acceptable for disposal in a sanitary

landfill, due to its chemical composition, source of generation, and/or physical form. Special wastes will also be transported and disposed of through Mattiola Services. Selection of a specific disposal facility for hazardous waste is contingent upon the quantity generated and composition of the waste material. All disposal related documents (TCLP results, manifests, etc.) will be submitted for approval by the Contracting Officer prior to waste shipment.

6.0 Spill Prevention and Control

This section presents the procedures for coordination of and response to potential spill or releases of hazardous/contaminated materials, including VOC-contaminated groundwater and operational chemical products. It is the intent to prevent all spills; however, some inadvertent releases may occur. Minor spills will generally be cleaned up by onsite personnel without formal reporting to management. Major spills will generally be deferred to local or state response authorities, and may require formal reporting to various agencies as discussed in Section 6.4.

6.1 Spill Prevention

Spill prevention during the project will be accomplished through the implementation of general control measures, secondary containment for liquid storage associated with the treatment systems, and best management practices for drum storage.

General Measures

The following measures shall be taken to minimize the possibility of spills/releases:

- Site security and controls are to be maintained so that only authorized personnel have access to work areas (refer to SSHP).
- Site personnel will be advised of appropriate spill/discharge control measures.
- Containers will remain closed except when adding/dispensing product.
- Containers will be stored upright and in an orderly fashion.
- Appropriate secondary containment structures (see below) will be used for storage of fluids on-site.
- Storage containments and piping systems will be examined daily to verify their integrity.
- Treatment system design will include overflow protection and loss of pressure shut-off switches.
- Small containers of chemical product will be stored inside the job box or treatment building when not in use. Flammable products will be stored inside approved cabinets.

Secondary Containment

The design of the treatment plant includes secondary containment for liquid spills/leaks inside the building. The perimeter of the process equipment area for the building will consist of a concrete berm (sill) of sufficient height to contain the 150% total fluid capacity of the equipment in the area.

Drum/Roll-off Storage Practices

A designated staging area will be established for the temporary storage of 55-gallon drums and roll-off containers. All drums will be stored on pallets within this area. Each day that field personnel are onsite, containers will be inspected for leaks, damage, corrosion, and bulging. Any container found to be leaking or on the verge of leaking due to damage or corrosion will be placed into an overpack drum or its contents will be transferred to another roll-off container.

Waste Transport Vehicles

Upon arrival of a waste transport vehicle, Arrowhead personnel shall visually inspect the condition of the waste vehicle and equipment in order to prevent spillage while on-site. Prior to leaving the site after loading, the waste transport vehicle and container shall be visually inspected for factors that may contribute to spills or releases during transport. Tarpaulins will be inspected to ensure they are secure and in good condition.

6.2 Spill Control Equipment

The following equipment and materials will be maintained at the project for use during spill response activities:

- Absorbent pads and socks
- Granular absorbent material (noncombustible)
- Polyethylene sheeting
- Shovels and assorted hand tools
- Drip pans
- 5-gallon buckets.

6.3 Spill Response

If a spill or other release of a hazardous/contaminated material occurs, the Site Supervisor and SSHO will be immediately notified. A list of contacts and telephone numbers is provided in Section 6.4.

An assessment will be made of the magnitude and potential impact of the release. As necessary, the spill will be reported in accordance with Section 6.4. If it is safe to do so, site personnel will attempt to locate the source of the release, prevent further release, and contain the spilled and/or affected materials as follows:

- The spill or release area will be approached from upwind (if outside).

- Hazards will be identified based on available information from witnesses or material identification documents (i.e., placards, MSDSs). The potential hazards will be evaluated to determine the proper personal protection levels, methods, and equipment necessary for response.
- If necessary, the spill area will be evacuated, isolated, and secured.
- The spill area will be sealed off using caution tape or other appropriate means.
- Entry to the spill area will be made by personnel with the PPE, training, methods, and equipment necessary to perform the work. Hazardous spill containment and collection will be performed as follows:
 - Contain the spill with absorbent socks, booms, granules, or construction of temporary dikes. Cover or dike floor drains, storm drains, and other conduits for off-site migration of the spilled material.
 - Control the spill at the source by plugging leaks, up-righting containers, over packing containers, or transferring contents of a leaking container.
 - Collect the spilled material with shovels and other equipment as necessary.
 - Store the spilled material in drums for further treatment or disposal.
 - Decontaminate personnel and equipment after the response is complete (refer to SSHP).

If site personnel cannot safely respond to an environmental release, evacuation of the area may be warranted. In the event of a significant spill, the local fire department will be notified at **911**. Upon arrival at the site, the Site Supervisor or SSHO will brief emergency responders of the current status and potential hazards. Following a spill incident, details shall be documented in accordance with the SSHP.

6.4 Spill Reporting

Minor spills, such as the slow leakage of oil from a piece of equipment located within the site boundaries, are not considered reportable spills. However, spills that occur during non-routine operations or releases outside the site boundaries, such as the inadvertent release of contaminated water to the sewer system, are reportable spills. Spills are required to be reported under 40 CFR 302, *Designation, Reportable Quantities and Notification*, if the quantity of the compound released exceeds the value listed in Table 302.4, "List of Hazardous Substances and Reportable Quantities," of the regulation. Typically, a spill of petroleum product greater than 25 gallons must be reported to State authorities. A reportable spill will also be accompanied by a standard spill incident report as per specification section 01351, paragraph 1.21, including:

- Type of release
- Source of release
- Contents of release

- Quantity of release
- Time of release
- List of whom was contacted, in order
- Any injuries incurred as a result of the release
- List of personnel involved
- Final disposition location

If a reportable quantity of a hazardous/contaminated material is released, the Site Supervisor and SSHO will be immediately notified. These individuals will then immediately notify CDM and the National Response Center at **(800) 424-8802** (if the quantity of spilled material exceeds a reportable quantity). If the spill consists of a petroleum product and exceeds 25 gallons, the NYSDEC will be contacted at **(631) 444-0400**. In all scenarios, CDM must be notified.

7.0 References

Code of Federal Regulations (CFR), Title 40, Part 302, *Designation, Reportable Quantities, and Notification*, U.S. Government Printing Office, Washington, D.C.

Code of Federal Regulations (CFR), Title 40, Part 300, *National Oil and Hazardous Substances Pollution Contingency Plan*, U.S. Government Printing Office, Washington, D.C.

Code of Federal Regulations (CFR), Title 40, Part 300.435, *Remedial Design/Remedial Actions, Operation and Maintenance*, U.S. Government Printing Office, Washington, D.C.

Code of Federal Regulations (CFR), Title 40, Part 136, *Test Procedures for the Analysis of Pollutants*, U.S. Government Printing Office, Washington, D.C.

QAPP Worksheet #1
Title and Approval Page

DRAFT REMEDIAL ACTION QUALITY ASSURANCE PROJECT PLAN (RA QAPP)
for
Remedial Action and Operation & Maintenance
Old Roosevelt Field Superfund Site
Garden City, New York

US Environmental Protection Agency (EPA) Region 2

Prepared by: Arrowhead Contracting, Inc.
10981 Eicher Dr.
Lenexa, Kansas 66219
(913) 814-9994

Date: September 22, 2010

Arrowhead Project Manager:

Doug Ronk, R.G.

Signature_____

Arrowhead Chemical Quality Control Officer

Scott Siegwald, CHMM

Signature_____

CDM Project Manager:

Thomas Matthew, P.E.

Signature_____

CDM RAC 2 Program Manager:

Jeanne Litwin

Signature_____

EPA Region 2 QA Officer:

Sergio Lopez-Luna, P.E.

Signature_____

Site Description

The Old Roosevelt Field Superfund Site is an area of groundwater contamination within the Village of Garden City, in central Nassau County, New York. The site is located on the eastern side of Clinton Road, approximately 0.6 mile south of the intersection with Old Country Road. The site includes a thin strip of open space along Clinton Road (known as Hazelhurst Park), a large retail shopping mall, and several office buildings (including Garden City Plaza) that share parking space with the shopping mall.

Two municipal water supply well fields are located south (hydraulically downgradient of the Site. The Village of Garden City public supply wells (designated at GWP-10 and GWP-11) are located just south of the site boundary, on the eastern side of Clinton Road. The Hempstead well field is located approximately 1.5 miles south of the Garden City supply wells. Two stormwater recharge basins are directly east and south of the mall area. The eastern basin, Pembroke, is located on property owned by the mall. The basin to the south is Nassau County Recharge Basin number 124.

Groundwater at the site is contaminated with volatile organic compounds (VOCs), particularly chlorinated VOCs such as tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), dichlorodifluoromethane and 1,2-dichloroethane (1,2-DCA), and non-chlorinated VOCs such as methyl ter-butyl ether (MTBE). The remedy, as defined in the September 2007 Record of Decision (ROD), involves groundwater extraction and ex-situ treatment (pump and treat) in order to expedite the restoration of water quality in the aquifer in comparison with natural processes alone, and provide for vapor intrusion mitigation, if deemed necessary.

Site History

The Site was used for aviation activities from 1911 to 1951. The United States military began using the Hempstead Plains field prior to World War I to train Army and Navy officers and as a training center for military pilots. In 1918, the Army changed the name of the airfield to Roosevelt Field.

After World War I, the US Air Service authorized aviation-related companies to operate from Roosevelt Field, but maintained control until July 1, 1920, at which time the Government sold its buildings and relinquished control of the field. Subsequently, the property owners sold portions along the southern edge of the field and split the remainder of the property into two flying fields. The eastern half continued as Roosevelt Field, and the western half became known as Curtiss Field. Both fields were bought in 1929 by Roosevelt Field, Inc. and the property was once again called Roosevelt Field.

During World War II, Roosevelt Field was once again used by both the Army and Navy. The Army used the field to provide airplane and engine mechanics training to Army personnel. As of March 1942, there were 6 steel/concrete hangars, 14 wooden hangars, and several other buildings at Roosevelt Field, which were used to receive, fuel, crate and ship Army aircraft. In November 1942, the Navy Bureau of Aeronautics established a modification center at Roosevelt Field to install British equipment into US aircraft for the British Royal Navy. The Navy was responsible for aircraft repair and maintenance, preparation and flight delivery of lend-lease aircraft, and metal work required for installation of British modifications. The facility also performed salvage work of crashed Royal Navy planes. The Navy vacated all but six hangars shortly after the war ended. In August 1946, Roosevelt Field again operated as a commercial airport until it closed in May 1951.

Chlorinated solvents such as PCE and TCE have been widely used for aircraft manufacturing, maintenance, and repair since the later 1930s. Several military instruction manuals for aircraft maintenance and repair were issued during this time period which was specifically related to the use of solvents such as TCE for cleaning airplane parts and for de-icing. The types of airplanes designated for solvents were reportedly present at the Site during World War II. As such, use of chlorinated solvents at the Site was very likely to have occurred.

Soon after the airfield closed, industrial plants for precision electronic instruments were under construction at Roosevelt Field and further development was planned. The large Roosevelt Field

Shopping Center was constructed at the site and opened in 1957. Three of the old Navy hangars remained standing until sometime after June 1971, with various occupants, including a moving/storage firm, discotheque, amusement center, and bus garage.

Garden City installed two public supply wells, GWP-10 and GWP-11 in 1952, at what had been the southwest corner of the airfield. These two wells were put into service in 1953. Over the subsequent years, several other supply wells and cooling water wells were installed and operated the former Roosevelt Field. In the late 1970s and early 1980s, investigations conducted by Nassau County found contaminants TCE and PCE in supply wells GWP-10 and GWP-11. High levels of contamination also were found in cooling water wells at the Site. The Site was listed on the National Priorities List (NPL) on May 11, 2000.

From June 2005 to December 2006, CDM, the Remedial Action Contractor for the Environmental Protection Agency (EPA), performed a remedial investigation (RI) at the Site to investigate the extent of groundwater contamination and to characterize the site geologic and hydrogeologic settings. During the RI, a total of 8 multiport monitoring wells were installed and two rounds of groundwater sampling were collected.

Following the RI, a feasibility study (FS) was completed to evaluate the remediation alternatives to treat the contaminant plume. Based on the findings in the RI and the recommendations in the Final FS, a ROD was signed in September 2007, selecting groundwater extraction and ex-situ treatment technologies to address the Site groundwater contamination.

Construction Activities

The goal of this project is to complete the design and construction of a Groundwater Treatment Facility (GWTF). Arrowhead's scope of work includes the following activities:

- Mobilizing to the site
- Preparing design documents
- Obtaining required permits
- Preparing the site, including setting up work zones, support areas, and laydown area (i.e. for equipment/vehicle/materials storage), and locating utilities
- Installing site utilities
- Installing GWTF transmission piping and well head construction
- Constructing a groundwater treatment plant
- Constructing/restoring miscellaneous site features including treatment facility parking area/access road, chain-link fencing, bollards, and pavement
- Completing site cleanup/demobilization
- Completing post-construction submittals

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Appendix A	New York State Department of Conservation, DER-10/Technical Guidance for Site Investigation and Remediation, Appendix 5 – Allowable Constituent Levels for Imported Fill or Soil
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QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project: Old Roosevelt Field Superfund Site
Remedial Action and Operation & Maintenance
Site Location: Garden City, New York
Operable Unit: Not Applicable (NA)
RA Subcontractor Name: Arrowhead Contracting, Inc.
Subcontract Number: 3320-023-001-CN-S
EPA Contractor CDM Federal Programs
Contract Title: Response Action Contract RAC2
Contract Number: EP-W-09-002
Work Assignment Number: 3320.023
Regulatory Program: CERCLA
Approval Entity: EPA Region 2
Is QAPP Generic or Project Specific: Project Specific
Dates of scoping sessions: July 23, 2010
Dates and Titles of QAPP Documents Written for Previous Site Work, if Applicable:

- Final Quality Assurance Project Plan (QAPP), Old Roosevelt Field Contaminated Groundwater Area Site: June 20, 2005;
- Final QAPP Addendum, Old Roosevelt Field Contaminated Groundwater Area Site: October 12, 2005.
- Final QAPP, Old Roosevelt Field Contaminated Groundwater Area Site Remedial Design: March 14, 2008.
- Final QAPP Addendum, Old Roosevelt Field Contaminated Groundwater Area Site Remedial Design: February 12, 2009
- Final QAPP, Old Roosevelt Field Contaminated Groundwater Area Site Remedial Action: May 24, 2010

Organizational Partners (stakeholders) and Connection with Lead Organization:
New York State Department of Environmental Conservation (NYSDEC)

Data Users:
CDM, EPA Region 2

Required QAPP elements and required information that are not applicable to the project, and an explanation for their exclusions:
N/A

QAPP Worksheet #2
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheets
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5 6 7 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	9 10
2.6 Project Quality Objectives (PQOs) and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 12

QAPP Worksheet #2
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheets
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2.8 Project Overview and Schedule	- Summary of Project Tasks	14
2.8.1 Project Overview	- Reference Limits and Evaluation Table	15
2.8.2 Project Schedule	- Project Schedule/Timeline Table	16
Measurement/Data Acquisition		
3.1 Sampling Tasks	- Sampling Design and Rationale	17
3.1.1 Sampling Process Design and Rationale	- Sample Location Map	18
3.1.2 Sampling Procedures and Requirements	- Sampling Locations and Methods/SOP Requirements Table	19
3.1.2.1 Sampling Collection Procedures	- Analytical Methods/SOP Requirements Table	20
3.1.2.2 Sample Containers, Volume, and Preservation	- Field Quality Control Sample Summary Table	21
3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures	- Sampling SOPs	
3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures	- Project Sampling SOP References Table	22
3.1.2.5 Supply Inspection and Acceptance Procedures	- Field Equipment Calibration, Maintenance, Testing, and Inspection Table	
3.1.2.6 Field Documentation Procedures		
3.2 Analytical Tasks	- Analytical SOPs	23
3.2.1 Analytical Standard Operating Procedures (SOPs)	- Analytical SOP References Table	
3.2.2 Analytical Instrument Calibration Procedures	- Analytical Instrument Calibration Table	24
3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	25
3.2.4 Analytical Supply Inspection and Acceptance Procedures		

QAPP Worksheet #2
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Required Worksheets
3.3 Sample Collection Documentation Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	<ul style="list-style-type: none"> - Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal 	26 27
3.4 Quality Control (QC) Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	<ul style="list-style-type: none"> - QC Samples Table - Screening/Confirmatory Analysis Decision Tree 	20, 28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	<ul style="list-style-type: none"> - Project Documents and Records Table - Analytical Services Table - Data Management SOPs 	29 30 14
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	<ul style="list-style-type: none"> - Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table 	31 32
4.2 Quality Assurance (QA) Management Reports	- QA Management Reports Table	33
4.3 Final Project Report		

QAPP Worksheet #2
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheets
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5.1 Overview		
5.2 Data Review Steps	- Verification (Step I) Process Table	34
5.2.1 Step I: Verification		
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**QAPP Worksheet #3
Distribution List**

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Caroline Kwan	RPM	US EPA	(212) 637-4275		kwan.caroline@epa.gov	
Thomas Matthew	Project Manager	CDM Federal Programs	(732) 225-7000	(732) 225-7851	MatthewT@cdm.com	
Ali Rahmani	Project Engineer	CDM Federal Programs	(732) 590-4727	(785) 225-7851	RahmaniMA@cdm.com	
Greg Wallace	Project Quality Control Manager	Arrowhead Contracting, Inc.	(913) 814-9994	(913) 814-9997	gwallace@arrowhead.org	
Doug Ronk	Project Manager	Arrowhead Contracting, Inc.	(913) 814-9994	(913) 814-9997	dronk@arrowhead.org	
Joe Cotter	Site Supervisor	Arrowhead Contracting, Inc.	(913) 961-5257	(913) 814-9997	jcotter@arrowhead.org	
Sara Goff	Subcontract Laboratory Project Manager	Test America	(802) 923-1027	(802) 660-1919	Sara.Goff@testamericainc.com	

QAPP Worksheet #4a
Project Personnel Sign-Off Sheet

Organization: Arrowhead

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Greg Wallace	Project Quality Control Manager	(913) 814-9994		
Doug Ronk	Project Manager	(913) 814-9994		
Joe Cotter	Site Supervisor	(913) 961-5257		
Sara Goff	Subcontract Laboratory Project Manager	(802) 923-1027		

QAPP Worksheet #4b
Project Personnel Sign-Off Sheet

Organization: CDM Federal Programs

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Thomas Matthew	Project Manager	(732) 590-4638		
Ali Rahmani	Project Engineer	(732) 590-4727		

QAPP Worksheet #4c
Project Personnel Sign-Off Sheet

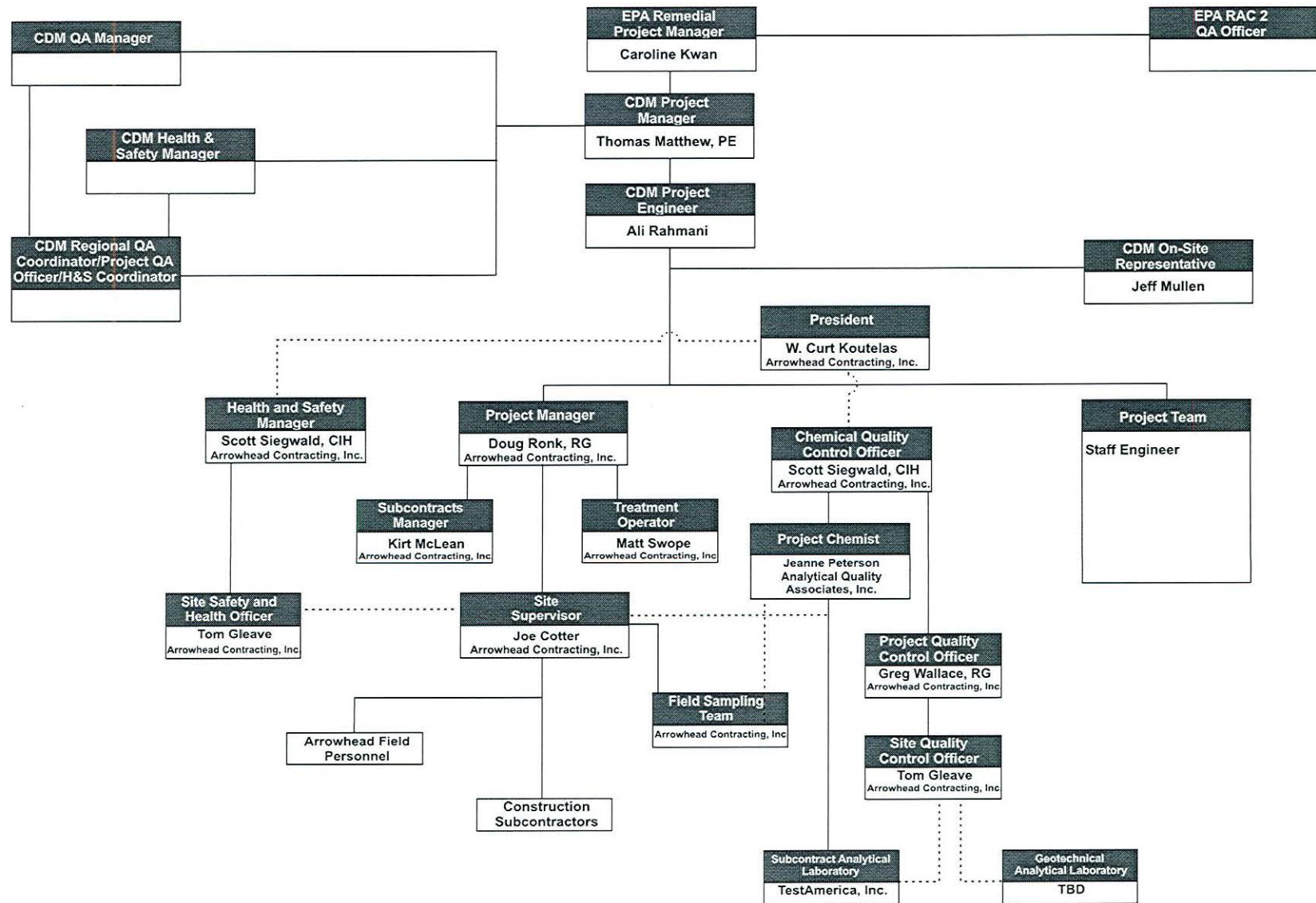
Organization: EPA

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Caroline Kwan	RPM	(212) 637-4275		

QAPP Worksheet #5
Project Organizational Chart

Refer to the attached Project Organization Chart

Figure 2-1
Project Organization Chart



**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Point of Contact with EPA RPM	CDM Project Manager	Thomas Matthew, P.E.	(732) 590-4638	All information about the project will be sent to Carolyn Kwan by the CDM PM. Field changes will be discussed with the EPA RPM prior to implementation. Communication as needed.
Manage remedial action activities	Arrowhead Site Supervisor	Joe Cotter	(913) 961-5257	Oversees all construction activities and reports to Arrowhead PM concerning RA activities performed by Arrowhead. Communication to be on a daily basis.
	Arrowhead Project Manager	Doug Ronk	(913) 814-9994	Manages all phases of construction activities. Provides regular updates to CDM PM and PE. Communication to be as needed but not less than weekly.
	CDM Project Engineer	Ali Rahmani	(732) 590-4727	Act as liaison to CDM PM concerning RA activities performed by the Arrowhead. Communication as needed.
	CDM Project Manager	Thomas, Matthew, P.E.	(732) 590-4638	Manages all subcontract personnel and reports progress to EPA. Communication as needed.

**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Change to field work	Arrowhead Site QCO	Tom Gleave	(913) 609-1252	Notify CDM On-Site Rep and Arrowhead PM and CQCO delays or changes to field work. Communication to occur within 4 hours of decision change is required.
	CDM On-Site Representative	TBD		Notify CDM PM and PE of delays or changes to field work. Communication to occur within 4 hours of notice from Arrowhead.
	CDM Project Engineer	Ali Rahmani	(732) 590-4727	Notified by Arrowhead immediately and complete a Field Change Request (FCR) form and/or corrected worksheets. Send FCR forms to RQAC. Notify ASC of delays.
Booking analytical services/Field testing services	Arrowhead Site Supervisor	Joe Cotter	(913) 961-5257	Submit request to Arrowhead PM. Notice to be made within 24 hours (onsite testing) or 7 days (offsite testing).
Field corrective action	Arrowhead Site QCO	Tom Gleave	(913) 609-1252	Notify CDM On-Site Rep and Arrowhead PM of delays or changes to field work. Communication to occur within 4 hours of decision change is required.

**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
	CDM Field Representative	Jeff Mullen	(315) 374-1923	Notify CDM PM and PE of delays or changes to field work. Communication to occur within 4 hours of notice from Arrowhead.
Analytical support	Arrowhead Chemical Quality Control Officer	Scott Siegwald	(913) 814-9994	Act as liaison with project laboratory.
Analytical data management planning and set-up	CDM Analytical Services Coordinator (ASC)	Scott Kirchner	(732) 590-4766	Provide analytical reporting format to the Arrowhead PM
Facilitate Data Management	Arrowhead Chemical Quality Control Officer	Scott Siegwald	(913) 814-9994	Provide electronic sample ID, locations and analyses of collected samples. Transmit completed sample tracking information to PE/RE by the completion of each sampling case. Communication as necessary.
	CDM PE	Ali Rahmani	(732) 590-4727	Notify Arrowhead of any changes required to database to help with reporting to EPA.

**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Reporting issues related to analytical data quality (i.e. sample integrity, holding time, analytical procedure deviations, corrective action)	Arrowhead Chemical Quality Control Officer	Scott Siegwald	(913) 814-9994	Notify CDM PE of any issues related to data quality
Release of Analytical Data	CDM Analytical Services Coordinator (ASC)	Scott Kirchner	(732) 590-4766	Receive and review data packages before data is used (only for CLP/DESA). Inform project team of data receipt and status of data.
Site Health and Safety issues	Arrowhead Site Health and Safety Officer	Tom Gleave	(913) 609-1252	Make decisions regarding health and safety issues and upgrading personal protective equipment (PPE). Communicate to Arrowhead Corporate HSO, Arrowhead PM, CDM On-Site Rep, and rest of field staff as appropriate. Communication to occur on a daily basis or more frequently as required.

**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
	CDM Field Representative	Jeff Mullen	(315) 374-1923	Notify CDM PE and PM of any changes to health and safety protocols or incidences. Communication to occur on a daily basis or more frequently as required.
QAPP Amendments	Arrowhead Site QCO	Tom Gleave	(913) 609-1252	Notify CDM PM and PE of need for amendment to QAPP. Communication to occur within 4 hours of notice from Arrowhead.
	Arrowhead Chemical Quality Control Officer	Scott Siegwald	(913) 814-9994	Prepare and submit QAPP Amendment form to CDM and communicate reason for changes as needed.

**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
	CDM Project Engineer	Ali Rahmani	(732) 590-4727	Notified by Arrowhead immediately and complete a QAPP Amendment form and/or corrected worksheets. Send to RQAC. Notify ASC of delays.

QAPP Worksheet #7
Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Thomas Matthew, P.E.	Project Manager	CDM	Manage overall project progress	
Ali Rahmani	Project Engineer	CDM	Review all design submittals and oversee construction	
Jeniffer Oxford	QA Coordinator/Project Chemist	CDM	Review analytical and test data for conformance with specifications and QAPP	
Jeff Mullen	Field Representative	CDM	Oversee construction activities for conformance with design documents and specifications	
Greg Wallace, R.G. *	Corporate Quality Control Officer	Arrowhead	Corporate Officer with overall responsibility for quality control	B.S. Geology + 26yrs experience. Arrowhead Vice President
Doug Ronk, R.G.*	Project Manager	Arrowhead	Oversee all project aspects	B.S. and M.S. Geology +11yrs experience.
Joe Cotter *	Site Supervisor	Arrowhead	Supervise all construction activities	B.S. Construction Management + 7yrs experience.
Tom Gleave *	Site Health and Safety Officer/Quality Control Officer	Arrowhead	Insure compliance with project Health and Safety plan and QAPP	B.S. Env. Engineering + 10 years experience
Scott Siegwald, CIH, CSP, CHMM	Corporate Health and Safety Officer	Arrowhead	Maintain communication with site H&S officer and conduct H&S audit as necessary	B.S and M.S. Environmental Engineering + 17yrs experience.
Scott Siegwald, CIH, CSP, CHMM	Chemical Quality Control Manager	Arrowhead	Review analytical data for QA compliance	B.S and M.S. Environmental Engineering + 17yrs experience.

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Activities Personnel entering the Exclusion Zone or Contamination Reduction Zone for excavation work	40-hour OSHA Training and Annual 8 hour refresher	40 hour - EPA or vendor	various	All CDM personnel All Arrowhead and subcontractor personnel that will be potentially exposed to contamination	CDM staff, Arrowhead staff and subcontractor staff	Arrowhead project files at job site and CDM project files at job site, as appropriate
All Field Activities	Site Supervisor Training	Arrowhead Corporate HSO or Vendor	various	Arrowhead Site HSO	Arrowhead Site HSO	Arrowhead project files at job site
Groundwater Treatment Facility (GWTF) Construction	10-hour OSHA Construction Training	Arrowhead Corporate HSO or vendor	various	Arrowhead staff and subcontractors involved in GWTF construction	Arrowhead staff and subcontractors involved in GWTF construction	Arrowhead project files at job site
All Field Activities	CPR/First Aid	Red Cross or CINTAS	Periodically as required (1 - 3 years)	At least 1 Arrowhead staff on site	At least 1 Arrowhead staff on site	Arrowhead project files at job site
Sample Collection	Trained in EPA Region 2 CERCLA sampling methods, and field testing procedures	On-site training	various	All personnel that performs sample collection	All personnel that performs sample collection	Onsite

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Sample Analysis	Trained in EPA and standard analytical methods	Laboratory and vendor training	various	Test America (Subcontract laboratory) personnel - TBD	Laboratory personnel	Laboratory
Data Validation	Data validation	Subcontractor training	Various	Arrowhead Chemical Quality Control Officer	Arrowhead Chemical Quality Control Officer	Arrowhead Home Office
Data Review/ Assessment	None, performed by experienced chemists	N/A	various	Arrowhead Chemical Quality Control Officer	Arrowhead Chemical Quality Control Officer	Arrowhead Home Office
QA Audits	EPA G-7 auditor training and CDM QA Specialists training	CDM/ASQ/ EPA courses	various	CDM auditors	CDM auditors	CDM

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Operation and Maintenance	Minimum 5 years of operation and maintenance experience for comparable treatment systems. The facility operator qualifications will be in accordance with the requirements of New York State for both water and wastewater treatment plant operation.	N/A	various	N/A	Arrowhead Operator	Arrowhead Office

**QAPP Worksheet #9
Project Scoping Session Participants Sheet**

Projected Date(s) of Sampling: Oct 2010 through October 2012			Site Name: Old Roosevelt Field Superfund Site	
Project Manager: Doug Ronk			Site Location: Garden City, NY	
Date of Session: July 23, 2010				
Scoping Session Purpose: Kick-off Meeting				
Name	Affiliation	Phone #	E-mail Address	Project Role
Thomas Matthew, P.E.	CDM	(732) 590-4638	Matthewt@cdm.com	Project Manager
Ali Rahmani	CDM	(732) 590-4727	rahmanimd@cdm.com	Project Engineer
Vernon Wimberley	CDM	(703) 968-0900	wimberleyv@cdm.com	Contract Officer
Greg Wallace, R.G.	Arrowhead	(913) 461-3828	gwallace@arrowhead.org	Project QCO
Doug Ronk, R.G.	Arrowhead	(913) 461-3828	dronk@arrowhead.org	Project Manager

Comments/Decisions: Design will begin once EPA has made a decision on the building size. EPA's decision would mostly likely be made following the results of sampling of the newly installed extraction wells. Results of the chemical analysis of these samples are due on or around September 23, 2010.

Action Items: Arrowhead will begin preparation of Work Plans and begin planning for Site Preparation activities to begin in September 2010.

Consensus Decisions: As described above._

QAPP Worksheet #10 Problem Definition

Problem Summary

The Remedial Investigation (RI) Report, Feasibility Study (FS) report, and Record of Decision (ROD), and Remedial Design (RD) have been completed for the Old Roosevelt Field Superfund Site (Site). The RI/FS identified groundwater contaminated with volatile organic compounds (VOCs), including tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and 1,1-dichloroethene (1,1-DCE). The highest observed concentrations in groundwater derived from RI and Pre-Remedial Design Investigation are as follows:

TCE	960 ug/l
PCE	300 ug/l
1,2 - DCE	69 ug/l
1,1 - DCE	23 ug/l

The ROD indicates that these contaminants pose unacceptable human health and/or ecological risks or exceed regulatory standards and therefore must be remediated through a Remedial Action (RA).

The following major remedial activities will be performed as part of the RA to address groundwater contamination at the Site.

- Construction and operation of a groundwater extraction and treatment system at the Site with discharge of treated water to groundwater through a recharge basin. Groundwater will be treated by air stripping followed by bag filtration. Vapors emitted from the air stripper will be discharged directly to the atmosphere.
- Long-term Operations and Maintenance (O&M) of the groundwater treatment system.

Project Description

The following major activities will be performed in support of the project objectives:

1) Groundwater Treatment System

- Install underground influent and effluent transmission yard piping and complete wellheads
- Construction of groundwater treatment facility (GWTF)
- Perform System Startup Testing
- Operate and maintain the groundwater treatment system

Project Decision Conditions

Soil Sampling During Earthwork Construction Activities:

- Soil excavated during trenching or for the building foundation will need to be visually inspected to determine if it meets the criteria in the Specifications and Work Plan for use as on-site backfill. If found unsuitable the soil will be stockpiled and characterized for off-site disposal.
- Imported backfill materials will need to be assessed for composition and cleanliness to ensure it meets the criteria in the Specifications and Work Plan.
- Prior to constructing the treatment building foundation, a geotechnical investigation was conducted by a licensed geotechnical engineer. The requirements of the investigation will require removal of the upper 4 feet of surface soil and replace with structural fill. Design criteria mentioned in the report have been included in the foundation design.
- Imported topsoil will be characterized using sampling and laboratory analysis as discussed in the Specifications and Work Plan to ensure that the topsoil meets project requirements.

Start-up Testing:

- Groundwater influent, treated effluent and the air stripper off-gas will be characterized to determine whether the

QAPP Worksheet #10
Problem Definition

treatment system is meeting specified performance criteria and complies with discharge permit requirements.

Groundwater Treatment System Operation and Maintenance:

- Groundwater influent and treated effluent and the air stripper off-gas will be characterized to determine whether the treatment system is compliance with the discharge permit requirements.

QAPP Worksheet #11
Project Quality Objectives /Systematic Planning Process Statements

Who Will Use the Data?

EPA, NYSDEC, and CDM will use the data.

What Will Data be Used For?

- To confirm achievement of remedial system performance requirements, as specified in the RA subcontract documents (i.e., specifications, drawings, Arrowhead submittals)
- To confirm compliance with the NYSDEC State Pollution Discharge Elimination System (SPDES) permit equivalency and Air Pollution Control permit equivalency
- To obtain data for assessing RA progress and support decisions regarding treatment system O&M and optimization
- To confirm excess excavated/unsuitable soil is not contaminated
- To confirm imported granular material that will be used as backfill meets NYSDEC DER 10, Appendix 5 recommended soil cleanup criteria

What Type of Data is Needed?

The sampling program will include the following:

Soil Sampling For Earthwork Construction Activities

- Excess/unsuitable excavated material sampling: Target Compound List (TCL) volatile organic compounds (VOCs) and Target Analyte List (TAL) for metals
- Imported Granular Material Sampling: TCL VOCs including benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane, semi-volatiles (SVOCs) including aniline, Pesticides including parathion, polychlorinated biphenyls (PCBs), Herbicides (2,4,5-T, 2,4-D and silvex), and TAL Metals (including mercury)
- Topsoil Sampling: TCL VOCs including benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane, semi-volatiles (SVOCs) including aniline, Pesticides including parathion, polychlorinated biphenyls (PCBs), Herbicides (2,4,5-T, 2,4-D and silvex), TAL Metals (including mercury), grain size, and density testing
- Geotechnical Sampling: Geotechnical samples will be determined by the geotechnical engineer.
See Worksheet #30 for turnaround time (TAT)
Grain size and standard proctor analyses

Groundwater Treatment System

- Start-up Testing
 - Influent sampling and monitoring: TCL VOCs, Total Iron, Water quality Parameters (dissolved oxygen (DO), conductivity, pH, oxidation-reduction potential (ORP), turbidity, and temperature).
 - Process sampling and monitoring: TCL VOCs, Total Iron, Water Quality Parameters (Worksheet #18)
 - Groundwater Effluent Discharge Compliance: Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Oil and Grease, Nitrate and Nitrite, TAL Metals, Total Mercury, Total Cyanide, TCL VOCs, and pH.
 - Off-gas system samples: VOCs via TO-15 and screening for VOCs using a photoionization detector (PID)
 - Air discharge compliance samples: VOCs via TO-15
 - See Worksheet #30 for turnaround time (TAT)
 - Continuous water level data using in-situ data loggers will be used to collect the water level data. See Table 3 for which wells continuous water level data will be collected from.
- Treatment System Operations & Maintenance
 - Influent Sampling and Monitoring TCL VOCs, Total Iron, Water quality Parameters (worksheet #18).
 - Groundwater Effluent Discharge Compliance: Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Oil and Grease, Nitrate and Nitrite, TAL Metals, Total Mercury, Total Cyanide, TCL VOCs, and pH.
 - Off-gas system samples collected from the off-gas system exhaust stack sample port: VOCs via TO-15 and screening for VOCs using a PID
 - Air discharge compliance samples collected from the system exhaust stack sample port: VOCs via TO-15
See Worksheet #30 for turnaround time (TAT)

QAPP Worksheet #11
Project Quality Objectives /Systematic Planning Process Statements

Waste Disposal Characterization Sampling

- The number of samples and analyses will be collected in accordance with the EPA-approved disposal facility.

How “good” do the data need to be in order to support the environmental decision?

The project-specific action limits and quantification limits for each sampled media are specified on Worksheet #15 for all contaminants of potential concern (COPCs). All laboratory analyses will be performed by Arrowhead's subcontract laboratory, Test America. Data must meet the data quality objectives (DQOs) that have been specified for the site. CDM will review the Arrowhead's laboratory's qualifications to confirm that the laboratory is capable of performing the required analyses and that EPA requirements, including certifications, are met. Refer to worksheet 23 for analytical quality requirements.

Where, when, and how should the data be collected?

Figure 2 presents the project schedule. The samples will be collected in the vicinity of the Site. Worksheet #17a-I presents the sampling program design and rationale. Worksheet 18 presents the sampling locations and methods. Worksheet 21 provides the SOPs that govern the various types of sampling. Field Forms are included in Appendix E.

Who will collect and generate the data?

Arrowhead will collect the analytical samples that will be shipped to the laboratory for analysis. Arrowhead will collect backfill and topsoil samples, continuous and synoptic water levels, and samples from the treatment facility. Arrowhead will sample and dispose investigation derived waste (IDW). All laboratory analyses will be performed by Arrowhead's subcontract laboratory, Test America.

How will the data be reported?

Arrowhead will be responsible for data validation of all samples analyzed at the laboratory. Analytical data will be received in electronic and hard copy. All data generated during construction (i.e. materials testing reports) will be reported to CDM as it is received. EDD and level 4 data packages for chemical analysis will be submitted to CDM as they are received. Data requiring validation will be submitted to the project chemist shortly after receipt from the Test America. Analytical data along with field data will be uploaded to Environmental Quality Information Systems (EQulS) version 5.3.2 by CDM. The database query and reporting tools will be used to create databases as specified by the project team. The reports will be submitted to EPA for review.

How will the data be archived?

- Preliminary data will be e-mailed to CDM within the specified turnaround time
- Data from Arrowhead's subcontract laboratory, Test America, will be received in electronic format specified in the contract and validated by Arrowhead
- Final validated data will be submitted to CDM in electronic format and hard copy consistent with CLP deliverables
- Electronic data will be input into the project's EQulS database by CDM
- Hard copies of field data including field logs will be archived in the project files
- Hard copies of analytical data received by CDM will be archived in the project files for 10 years after contract expiration

QAPP Worksheet #12a
Measurement Performance Criteria Table

Matrix	Air				
Analytical Group	VOCs				
Concentration Level	Low (ppbv)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Off-gas System Sampling</u> TSOP 1-8	TO-15	Precision	$\pm 25\% D^*$	Field Duplicate	S & A
		Accuracy	No analyte > CRQL [*] , ^{**}	Field Blank	S & A
		Precision	$\pm 25\% D^*$	Laboratory Replicate Sample	A
		Accuracy	70-130 %R [*]	Laboratory Audit Standard (LCS)	A
		Accuracy	No analyte > CRQL ^{***}	Laboratory Method Blank	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units (ppbv) Detection Limits meet project quantification limit goals (PQLGs) ^{**}	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL	MRL	A

1. The subcontract laboratory, Test America, analytical criteria will be outlined in the laboratory SOWS and SOPs.

^{*}Reference Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by GC/MS, 2nd Edition, January 1999; Table 3 "Summary of Internal Quality Control Procedures for VOCs by EPA method TO-15, Revision

01/21/2000.

**Refer to Worksheet 15 for the required quantification limits.
Method Reporting Limit (MRL)

QAPP Worksheet #12b
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TCL VOCs				
Concentration Level	Low (µg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u> <u>Sampling of Excess/Unsuitable Excavated Soils</u>	SOM01.2	Precision	RPD ≤ 100% ² ABS ≤ 5xCRQL	Field Duplicates ³	S&A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank	A
		Accuracy	See Worksheet #28	LCS	A
		Precision	See Worksheet #28	MS/MSD**	S & A
		Accuracy	See Worksheet #28	***DMCs; MS/MSD**	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/kg)	Data Review - Compare results from each round	S&A

		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).

3. Only the field duplicate results will be affected since low precision may be due to non-homogenous soils. Data qualifiers will be applied to the field duplicate samples only.

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 33/ VOCs (SIM/ Low/ Medium) - Blank Type Criteria Table

**Optional MS/MSD – Reference CLP SOM01.2, Exhibit D, and Table 6 for Criteria – Not typically required for Region 2

***Deuterated Monitoring Compounds (DMCs) – Reference CLP SOM01.2, Exhibit D, Table 5 for Criteria

****Imported granular material is any material brought from offsite that will be used for backfill, grading, and miscellaneous site work as specified in Subcontract Specification Section 02300 – Earthwork, and shall include, but not be limited to, common fill, structural fill, select fill, crushed stone, and topsoil.

Method Reporting Limit (MRL)

QAPP Worksheet #12c
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TCL SVOCs				
Concentration Level	Low (µg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	SOM01.2	Precision	RPD ≤ 100% ² ABS ≤ 5xCRQL	Field Duplicates ³	S&A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank	A
		Precision	See Worksheet #28	MS/MSD**	S & A
		Accuracy	See Worksheet #28	***DMCs; MS/MSD**	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/kg)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL (ABS ≤ 5xCRQL).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 35/SVOCs - Blank Type Criteria Table

**Optional MS/MSD – Reference CLP SOM01.2, Exhibit D, and Table 6 for Criteria – Not typically required for Region 2

***Deuterated Monitoring Compounds (DMCs) – Reference CLP SOM01.2, Exhibit D, Table 5 for Criteria.

Method Reporting Limit (MRL)

QAPP Worksheet #12d
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TCL Pesticides				
Concentration Level	Low (µg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	SOM01.2	Precision	RPD $\leq 100\%^2$ ABS $\leq 5 \times \text{CRQL}$	Field Duplicates ³	S&A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank, Instrument Blanks	A
		Accuracy	See Worksheet #28	LCS	A
		Precision	See Worksheet #28	MS/MSD**	S & A
		Accuracy	See Worksheet #28	***Surrogates; MS/MSD**	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units (µg/kg)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($\text{ABS} \leq 5 \times \text{CRQL}$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 36/Low/Medium Pesticide - Blank Type Criteria Table

**MS/MSD – Reference CLP SOM01.2, Exhibit D, and Table 3 for Criteria – Not typically required for Region 2

***Laboratory Control Sample (LCS) – Reference CLP SOM01.2, Exhibit D, Table 2 for Criteria.

Method Reporting Limit (MRL)

QAPP Worksheet #12e
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TCL PCBs				
Concentration Level	Low (µg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	SOM01.2	Precision	RPD ≤ 100% ² ABS ≤ 5xCRQL	Field Duplicates ³	S&A
		Accuracy	No analyte > CRQL ⁴	Field Blank	S & A
		Accuracy	No analyte > CRQL [*]	Laboratory Method Blank, Instrument Blanks	A
		Precision	See Worksheet #28	MS/MSD ^{**}	S & A
		Accuracy	See Worksheet #28	***Surrogate, LCS; MS/MSD ^{**}	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/kg)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL (ABS ≤ 5xCRQL).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet # 15 for the required quantification limits.

^{*}Reference EPA Region 2 SOP No. 36/Low/Medium Pesticide - Blank Type Criteria Table

^{**}MS/MSD – Reference CLP SOM01.2, Exhibit D, and Table 3 for Criteria – Not typically required for Region 2

^{***}Laboratory Control Sample (LCS) – Reference CLP SOM01.2, Exhibit D, Table 2 for Criteria.

Method Reporting Limit (MRL)

QAPP Worksheet #12f
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TAL Metals				
Concentration Level	low (mg/kg)				
Sampling Procedure	Analytical Method/SO¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u> <u>Sampling of Excess/Unsuitable Excavated Soils</u>	ISM01.2 ICP-AES	Precision	$\leq 100\%$ RPD ^{*.2} ABS $\leq 5 \times$ CRQL	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*.4}	Field Blank	S & A
		Accuracy	No analyte > CRQL [*]	Laboratory Method Blank, Calibration Blanks	A
		Precision	$\pm 35\%$ RPD	Laboratory Duplicate Sample **	A
		Accuracy	75-125%	Matrix Spike***	A
		Accuracy	70-130% (50-150% Ag and Sb)	LCS****	A
		Accuracy	<10% Difference	Serial Dilution (ICP)	A
		Sensitivity	70-130%	CRQL	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units ($\mu\text{g/L}$)	Data Review - Compare results from each round	S&A

		Sensitivity	70-130% except Cobalt, Manganese, and Zinc (50-150%). Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWs and SOPs.
2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).
3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
4. See Worksheet #15 for the required quantification limits.

ICP-AES = inductively coupled plasma-atomic emission spectroscopy

*Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

**Reference EPA CLP ISM01.2, Exhibit D of ICP-AES for Duplicate Sample Criteria

***Reference EPA CLP ISM01.2, Exhibit D of ICP-AES for Spike Sample Criteria

****Reference EPA CLP ISM01.2, Exhibit D of ICP-AES for Laboratory Control Sample (LCS) .

Method Reporting Limit (MRL)

QAPP Worksheet #12g
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TAL –Total Mercury				
Concentration Level	low (mg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	ISM01.2 CVAA	Precision	$\leq 100\%$ RPD ^{*,2} ABS $\leq 5 \times$ CRQL	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank, Calibration Blanks	A
		Precision	$\pm 35\%$ RPD ²	Laboratory Duplicate Sample **	A
		Accuracy	75–125%	Matrix Spike***	A
		Sensitivity	70–130%	CRQL	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units ($\mu\text{g/L}$)	Data Review - Compare results from each round	S&A

		Sensitivity	70-130%. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.
 2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).
 3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
 4. See Worksheet #15 for the required quantification limits.
- *Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP – (include absolute difference criteria)
**Reference EPA CLP ISM01.2, Exhibit D Mercury for Duplicate Sample Criteria
***Reference EPA CLP ISM01.2, Exhibit D Mercury for Spike Sample Criteria.
- Method Reporting Limit (MRL)

QAPP Worksheet #12h
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	Herbicide (2,4,5-T, Silvex, 2,4-D)				
Concentration Level	low (mg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	SW-846 8151	Precision	$\leq 100\%$ RPD ² ABS $\leq 5 \times$ CRQL*	Field Duplicate	S & A
		Accuracy	No analyte > QL*	Field Blank	S & A
		Accuracy	No analyte > CRQL*	Laboratory Method Blank, Instrument Blanks	A
		Precision	See Worksheet #28	MS/MSD	S & A
		Accuracy	See Worksheet #28	Surrogate, LCS MS/MSD	A
		Completeness	$\geq 90\%$	Data Assessment	S&A
		Comparability	Similar Units ($\mu\text{g/L}$)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

¹ The subcontract laboratory, Test America, will provide the SOP as part of the procurement.

² RPDs (relative percent difference) will be determined for all detected results. The absolute difference (ABS) will be calculated for all

results failing the RPD; where only one result is detected; or one or both results are reported below the quantification limit (QL).

*Refer to Worksheet 15 for the required quantification limits .
Method Reporting Limit (MRL)

QAPP Worksheet #12i
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	Grain size, Standard Proctor, In-Place Compaction Test				
Concentration Level	Hydrometer				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria*	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Onsite Excavated Soil and Imported Granular Material Sampling and Testing of In-Place Compaction of Imported Backfill</u> <u>Testing of Excavated Materials to be Used as On-Site Backfill</u>	ASTM D421-85 & D422-63, ASTM D698, ASTM D1556-07 or D2168-08	Precision/Accuracy	Per ASTM method	Per ASTM method	S & A

¹ The subcontract laboratory, Test America, will provide the SOP as part of the procurement.

² The full range of particles will be reported.

³ Laboratory will be notified of estimated contaminant concentrations for H&S purposes.

QAPP Worksheet #12j
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TCL VOCs				
Concentration Level	Trace (µg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up – Influent/Process/Compliance Sampling</u> <u>O&M – Influent/Process/Compliance Sampling</u>	SOM01.2 Trace Water	Precision	RPD ≤ 25% ² ABS ≤ 5xCRQL	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ⁴	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank	A
		Precision	See Worksheet #28	MS/MSD**	S & A
		Accuracy	See Worksheet #28	***DMCs;LCS MS/MSD**	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A

		Sensitivity	ICAL at or below RL.) Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these measurement performance criteria (MPCs).

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 33 for Low/Medium VOA - Blank Type Criteria Table

**Optional MS/MSD – Reference CLP SOM01.2, Exhibit D, and Table 6 for Criteria – Not typically required for Region 2

***Deuterated Monitoring Compounds (DMCs) – Reference CLP SOM01.2, Exhibit D, Table 5 for Criteria.

Method Reporting Limit (MRL)

QAPP Worksheet #12k
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TAL Metals , Total Iron				
Concentration Level	Low (µg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up – Influent/Process/Compliance Sampling</u> <u>O&M – Influent/Process/Compliance Sampling</u>	ISM01.2 ICP-AES	Precision	≤ 20% RPD ^{*,2} ABS ≤ 5xCRQL	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank, Calibration Blanks	A
		Precision	≤ 20% RPD ^{*,2}	Laboratory Duplicate Sample **	A
		Accuracy	75–125%	Matrix Spike***	A
		Accuracy	80-120% Except Ag and Sb	LCS ****	A
		Accuracy	<10% Difference	Serial Dilution (ICP)	A
		Sensitivity	70–130%	CRQL	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A

		Sensitivity	70-130%. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.
 2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).
 3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
 4. See Worksheet #15d for the required quantification limits.
- ICP-AES = inductively coupled plasma-atomic emission spectroscopy
- *Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)
- **Reference EPA CLP ISM01.2, Exhibit D of ICP-AES for Duplicate Sample Criteria - (include absolute difference criteria)
- ***Reference EPA CLP ISM01.2, Exhibit D of ICP-AES for Spike Sample Criteria
- ****Reference EPA CLP ISM01.2, Exhibit D of ICP-AES for Laboratory Control Sample (LCS) Criteria .
- Method Reporting Limit (MRL)

QAPP Worksheet #12m
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TAL –Total Mercury				
Concentration Level	low (µg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up –Compliance Sampling</u> <u>O&M –Compliance Sampling</u>	ISM01.2 CVAA	Precision	≤ 20% RPD ^{*,2}	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank, Calibration Blanks	A
		Precision	≤ 20% RPD ^{*,2}	Laboratory Duplicate Sample **	A
		Accuracy	75–125% 80-120%	*** Matrix Spike; LCSW****	A
		Sensitivity	70–130%	CRQL	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A

		Sensitivity	70-130%. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.
 2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).
 3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
 4. See Worksheet #15 for the required quantification limits.
- *Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)
**Reference EPA CLP ISM01.2, Exhibit D Mercury for Duplicate Sample Criteria - - (include absolute difference criteria)
Reference EPA CLP ISM01.2, Exhibit D Mercury for Spike Sample Criteria *Reference EPA CLP ISM01.2, Exhibit D Mercury for solid Laboratory Control Sample (LCS) Note: Control Limits established by EPA for LCS.
Method Reporting Limit (MRL)

QAPP Worksheet #12m
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TAL –Total Cyanide				
Concentration Level	low (µg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up –Compliance Sampling</u> <u>O&M –Compliance Sampling</u>	ISM01.2	Precision	≤ 20% RPD ^{*.2}	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*.4}	Field Blank	S & A
		Accuracy	No analyte > CRQL [*]	Laboratory Method Blank	A
		Precision	≤ 20% RPD ^{*.2}	Duplicate Sample ^{**}	A
		Accuracy	75–125% 85–115%	*** Matrix Spike; LCSW	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A

		Sensitivity	70-130%. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet #15 for the required quantification limits.

*Reference USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, 2002- (include absolute difference criteria)

**Reference EPA CLP ISM01.2, Exhibit D Cyanide for Duplicate Sample Criteria - - (include absolute difference criteria)

***Reference EPA CLP ISM01.2, Exhibit D Cyanide for Spike Sample Criteria

Method Reporting Limit (MRL)

QAPP Worksheet #12n
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	Nitrate/Nitrite				
Concentration Level	low (mg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up – Compliance Sampling</u> <u>O&M– Compliance Sampling</u>	353.2	Precision	$\leq 25\%$ RPD ² ABS $\leq 5 \times$ QL	Field Duplicate	S & A
		Accuracy	No analyte > QL*	Field Blank	S & A
		Precision	$\leq 20\%$ RPD*	Laboratory Duplicate Sample	A
		Accuracy	No analyte > QL*	Method Blank	A
		Accuracy	Instrument Performance Check Solution	90-110%	A
		Accuracy	75–125%; 90-110% recovery**	Matrix Spike; LCSW	A
		Completeness	$\geq 90\%$	Data Assessment	S & A
		Comparability	Similar Units (mg/L) Detection limits meet project goals	Data Review	S & A

		Sensitivity	70-130%	MRL	A
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¹ The subcontract laboratory, Test America, will provide the SOP as part of the procurement.

² RPDs (relative percent difference) will be determined for all detected results. The absolute difference (ABS) will be calculated for all results failing the RPD; where only one result is detected; or one or both results are reported below the quantification limit (QL).

*Refer to Worksheet 15 for the required quantification limits

**Reference USEPA Method 353.2

Method Reporting Limit (MRL)

QAPP Worksheet #12m
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	Oil and Grease				
Concentration Level	low (mg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up – Compliance Sampling</u> <u>O&M – Compliance Sampling</u>	1664A	Precision	≤ 20% RPD ^{*2}	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*4}	Field Blank	S & A
		Accuracy and Precision	83-101% RPD≤11	Initial Precision and Recovery	A
		Accuracy	No analyte > CRQL ^{*4}	Laboratory Method Blank	A
		Precision	≤ 20% RPD ^{*2}	Laboratory Duplicate Sample *	A
		Accuracy	78-114%*	* Matrix Spike; LCS (ongoing precision and recovery)	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L) Detection Limits meet project quantification limit goals (PQLGs) ⁴	Data Review - Compare results from each round	S&A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results

failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet #15 for the required quantification limits.

*Reference USEPA Method 1664a.

QAPP Worksheet #12o
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TDS, TSS				
Concentration Level	low (mg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start up – Compliance Sampling</u> <u>O&M – Compliance Sampling</u>	Total Dissolved Solids Total Suspended Solids – SM2540C/SM2540D	Precision	≤ 25% RPD ² ABS ≤ 5xQL	Field Duplicate	S & A
		Accuracy	No analyte > QL*	Field Blank	S & A
		Precision	≤ 20% RPD**	Duplicate Sample	A
		Accuracy	No analyte > QL*	Method Blank	A
		Accuracy	85-115% recovery**	LCS	A
		Completeness	≥ 90%	Data Assessment	S & A
		Comparability	Similar Units (mg/L) Detection limits meet project goals	Data Review	S & A

¹ The subcontract laboratory, Test America, will provide the SOP as part of the procurement.

² RPDs (relative percent difference) will be determined for all detected results. The absolute difference (ABS) will be calculated for all results failing the RPD; where only one result is detected; or one or both results are reported below the quantification limit (QL).

*Refer to Worksheet 15 for the required quantification limits**Reference applicable method.

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	Data Source (Originating Organization, Report Title, and Date)	How Data Will Be Used	Limitations on Data Use
Soil and groundwater results collected during the RI investigation	Old Roosevelt Field Superfund Site	CDM Remedial Investigation (2007)	Data used to determine pre-design investigation boring and well locations	None
Groundwater & soil sample results collected during the pre-design investigation	Old Roosevelt Field Superfund Site	CDM Data Evaluation Report (2008)	Data used for additional information required for the Remedial Design (RD).	None
RA Step Test of Extraction Wells	Old Roosevelt Field Superfund Site	CDM (2010)	Data used for the Remedial Action (RA).	None

QAPP Worksheet #14 Summary of Project Tasks

Sampling Tasks: Sampling tasks are summarized below:

Soil Sampling For Earthwork Construction Activities

- Excess excavated material sampling
 - 1 sample per 100 cubic yards (CY) to be shipped offsite
 - See Worksheet #18 for analytical list
- Imported granular material sampling
 - A minimum of one chemical test will be performed per every 5,000 CY of each type of material to be used and no less than one test per borrow area
 - Total number of samples will be determined based on the amount of imported material brought from off-site
 - See Worksheet #18 for analytical list

Groundwater Treatment System

- Start-up (Initial Testing Period (ITP) (see Table 1800-1 in Contract Specifications)
 - Step 1 – Individual Well Testing (Days 1 through 3 of ITP)
 - 3 influent samples (one sample per day) collected from sample in line with EW-1S, EW-1I, and EW-1D
 - 3 process samples (one sample per day); collected after the EQ Tank
 - 3 compliance samples (one sample per day); collected after the static mixture following caustic injection
 - 1 compliance sample collected from air stripper exhaust discharge stack during Day 1 of ITP
 - Continuous pH readings following static mixture located after caustic injection
 - Water level reading from data loggers installed in GWX-10019, GWX-10020, MW-01(S-1), and SVP-10
 - Continuous pH reading from probe installed after static mixture located after caustic infection point
 - Continuous flow measurements in line with pipe from each extraction well and after effluent transfer pump
 - See Worksheet #18 for analytical list
 - Step 2 –Testing While all Three Extraction Wells are in Operation (Days 4 through 14 of ITP)
 - 2 total influent samples (one sample per day on Days 5 and 10 of ITP) collected in the header pipe after the flows from the extraction wells are combined
 - 2 process samples (one sample per day on Days 5 and 10 of ITP); collected after the EQ tank
 - 2 compliance samples (one sample per day on Days 5 and 10 of ITP); collected after the static mixture following caustic Injection
 - 2 compliance samples (one sample per day on Days 5 and 10 of ITP) collected from air stripper exhaust discharge stack
 - Continuous pH readings following static mixture located after caustic injection
 - Water level reading from data loggers installed in GWX-10019, GWX-10020, MW-01(S-1), and SVP-10
 - Continuous pH reading from probe installed after static mixture located after caustic infection point
 - Continuous flow measurements in line with pipe from each extraction well and after effluent transfer pump
 - See Worksheet #18 for analytical list
- Operation and Maintenance (Year 1)
 - Monthly influent samples collected from the header after the flow is combined from all the extraction wells

- Weekly monitoring of water quality parameters at influent sample port in header and effluent sampling port after static mixer
- Weekly compliance samples collected after the static mixture following caustic Injection and analyzed for TDS and TSS
- Bimonthly compliance samples collected after the static mixture following caustic Injection and analyzed for TCL VOCs and Oil and Grease
- Monthly compliance samples collected after the static mixture following caustic Injection and analyzed for TAL Metals and Nitrate/Nitrite
- Quarterly compliance samples collected after the static mixture following caustic Injection and analyzed for Total Cyanide and Total Mercury
- 39 compliance samples (one sample per week during first six month and then bimonthly thereafter) collected from air stripper exhaust discharge stack
- Continuous pH readings following static mixture located after caustic injection
- Continuous pH reading from probe installed after static mixture located after caustic infection point
- Continuous flow measurements in line with pipe from each extraction well and after effluent transfer pump
- See Worksheet #18 for analytical list

Waste Disposal Characterization Sampling

- The number of samples and analyses will be collected in accordance with the EPA-approved disposal facility.

Quality Control Tasks:

Soil and water will have one or more of the following QC samples analyzed: field duplicates, matrix spike/matrix spike duplicates, trip blanks, rinsate blanks, and all other QA/QC samples as defined in the method.

Secondary Data:

Secondary data is listed in Worksheet #13. The RI and pre-design investigation data have already been uploaded in the project database. This data was used to refine/confirm the extent of contamination to prepare the remedial design.

Data Management Tasks:

Analytical data will be imported into the EQuIS database after validation. Field measurements will also be added to the database.

Analytical data will be loaded into CDM's EQuIS database.

- Preliminary data will be e-mailed to CDM within the specified turn-around-time.
- Data from Arrowhead's subcontract laboratory, Test America, will be received in electronic format specified in the contract and validated by Arrowhead.
- All final laboratory data will be submitted to CDM in electronic format consistent with CLP deliverables. CDM will review all analytical data.
- Hard copies of analytical data received by CDM will be archived in project file.
- Electronic data will be uploaded into the project's EQuIS database by CDM
- Electronic data will be consistent with EPA Region 2 requirements for electronic data deliverable (EDDs) CDM will forward the EDDs to EPA.
- Electronic analytical data will be archived on CDs and copies of CDs will be forwarded to the USEPA.

Arrowhead is responsible for tracking samples from the point of field collection to submittal for laboratory analysis and the subsequent data validation and data management efforts. The sample handling and custody requirements, including field logs and generation of sample paperwork,

sample labels and custody seals (TSOP 1-2) discussed in Worksheets #26 and #27, will be followed. The laboratory QA requirements including laboratory audits and contract compliance screening will be followed according to procedures described below and in Worksheet #23. The

The following information is recorded in the tracking system:

Sample Number

- I. Area of Concern
- II. Sample Matrix
- III. SDG Number
- IV. CLP Case No.
- V. CLP No.
- VI. Analytical Parameter
- VII. Collection Date
- VIII. Shipment Date
- IX. Date Received from Lab
- X. Date Submitted for Data Validation
- VI. Name of Data Validator
- VII. Date of Data Validation Completion
- VIII. Database Entry Date
- IX. Database QC Date
- X. Comments (i.e., MS/D designation, duplicate samples).

Analytical data collected during the field effort will be entered into an EQuIS database management system. CDM will establish and maintain an EQuIS database for organization and management of the sample data and information collected during the system performance testing of the RA. To facilitate the use of the database, CDM will provide the Arrowhead with a detailed format specification for the delivery of analytical data in an EDD. Once it is uploaded into the database, validated analytical data will be organized, formatted, and input into the database for use in the data evaluation phase.

Reporting

Arrowhead will prepare monthly O&M reports that will include, but is not limited to, summary of operation and maintenance activities, average flow rates, volume of treated water, waste disposal information, level of labor effort, monitoring data and measurements, technical support activities, health and safety activities, utility use quantities and cost and programmable logic controller (PLC) files. Monthly O&M reports will undergo a technical review prior to submission to the CDM. The review will be performed by a qualified reviewer to ensure technical accuracy and conformance with the requirements herein. All calculations, tables, charts, analytical data, and data sheets shall be checked by an independent reviewer. CDM will be responsible for ANSETS reporting.

Documentation and Records:

Information regarding samples will be recorded in site field logs. Any changes that are made to the field logs will be initialed and dated. Documents will be maintained in the project files. Monitoring well purge water data forms will be completed for each sample collected. Chain-of-Custody (COC) and air-bills will also be completed for each sampling event. Calibration logs will be completed for each sampling instrument and maintained in the project files.

Field Change Requests:

In the event that anticipated conditions are different from those encountered once the field work is under way, it may be necessary to implement a deviation from the approved QAPP. When such changes are required, the proposed change will be documented on a field change request (FCR) Form approved by CDM's PM. A copy of the FCR Form is included in Appendix C. A copy of the FCR will be kept on site along with the approved QAPP. A copy of the FCR form will be distributed to the authorizing parties in order to keep all staff informed of the change and to allow oversight of any changes.

When significant field changes occur, the QAPP will be revised. Modifications will be carried out via revised pages to the QAPP. Minor changes will be made through formal memoranda to CDM and will be included as addenda to the QAPP. The complete sign-off procedure will be followed if, in the judgment of CDM, major revisions to the QAPP are required. All revisions to the QAPP will be subject to CDM's internal review process.

QAPP Worksheet #15a
Reference Limits and Evaluation Table – VOC Water

Analyte/Method	CAS Number	Lab Method Detection Limit Water (ug/L)	Method Reporting Limit (ug/L)	Project Quantitation Limit Water (ug/L)	Project Action Level Water (ug/L)
1,1,1-Trichloroethane	71-55-6	0.028	0.5	5	
1,1,2,2-Tetrachloroethane	79-34-5	0.08	0.5	5	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.03	0.5	5	
1,1,2-Trichloroethane	79-00-5	0.073	0.5	1	
1,1-Dichloroethane	75-34-3	0.053	0.5	5	
1,1-Dichloroethene	75-35-4	0.038	0.5	5	
1,2,3-Trichlorobenzene	87-61-6	0.029	0.5	5	
1,2,4-Trichlorobenzene	120-82-1	0.047	0.5	5	
1,2-Dibromo-3-chloropropane	96-12-8	0.25	0.5	0.04	
1,2-Dichlorobenzene	95-50-1	0.051	0.5	3	
1,2-Dichloroethane	107-06-2	0.057	0.5	0.6	
1,2-Dichloropropane	78-87-5	0.053	0.5	1	
1,3-Dichlorobenzene	541-73-1	0.042	0.5	3	
1,4-Dichlorobenzene	106-46-7	0.035	0.5	3	
2-Butanone	78-93-3	0.61	5	NL	
2-Hexanone	591-78-6	0.29	5	NL	
4-Methyl-2-pentanone	108-10-1	0.36	5	NL	
Acetone	67-64-1	0.93	5	NL	
Benzene	71-43-2	0.03	0.5	1	
Bromochloromethane	74-97-5	0.072	0.5	5	
Bromodichloromethane	75-27-4	0.043	0.5	NL	
Bromoform	75-25-2	0.066	0.5	NL	
Bromomethane	74-83-9	0.05	0.5	5	
Carbon disulfide	75-15-0	0.06	0.5	60	
Carbon tetrachloride	56-23-5	0.038	0.5	5	
Chlorobenzene	108-90-7	0.039	0.5	5	
Chloroethane	75-00-3	0.069	0.5	5	
Chloroform	67-66-3	0.047	0.5	7	
Chloromethane	74-87-3	0.097	0.5	5	

QAPP Worksheet #15a
Reference Limits and Evaluation Table – VOC Water

Analyte/Method	CAS Number	Lab Method Detection Limit Water (ug/L)	Method Reporting Limit (ug/L)	Project Quantitation Limit Water (ug/L)	Project Action Level Water (ug/L)
cis-1,2-Dichloroethene	156-59-2	0.052	0.5	5	1
cis-1,3-Dichloropropene	10061-01-5	0.036	0.5	0.4	0.4
Cyclohexane	110-82-7	0.04	0.5	NL	NL
Dibromochloromethane	124-48-1	0.047	0.5	NL	NL
Dichlorodifluoromethane	75-71-8	0.025	0.5	5	1
Ethylbenzene	100-41-4	0.05	0.5	5	1
Isopropylbenzene	98-82-8	0.044	0.5	5	1
m,p-Xylene	108-38-3 106-42-3	0.033	0.5	5	1
Methyl acetate	79-20-9	0.075	0.5	NL	NL
Methyl tert-butyl ether	1634-04-4	0.032	0.5	NL	NL
Methylcyclohexane	108-87-2	0.049	0.5	NL	NL
Methylene chloride	75-09-2	0.06	0.5	5	1
o-Xylene	95-47-6	0.041	0.5	5	1
Styrene	100-42-5	0.057	0.5	5	1
Tetrachloroethene	127-18-4	0.051	0.5	5	1
Toluene	108-88-3	0.031	0.5	5	1
trans-1,2-Dichloroethene	156-60-5	0.018	0.5	5	1
trans-1,3-Dichloropropene	10061-02-6	0.031	0.5	0.4	0.05
Trichloroethene	79-01-6	0.054	0.5	5	1
Trichlorofluoromethane	75-69-4	0.052	0.5	5	1
Vinyl chloride	75-01-4	0.049	0.5	2	1

Project action levels are from NYSDEC Surface and Groundwater Quality Standards March 28, 2003
Method reporting limit for SOM 01.2
ug/L – micrograms per liter
NL – Not Listed

QAPP Worksheet #15b
Reference Limits and Evaluation Table – Metals Water

Analyte/Method	CAS Number	Lab Method Detection Limit Water (ug/L)	Method Reporting Limit (ug/L)	Project Quantitation Limit Water (ug/L)	Project Action Level Water (ug/L)
Mercury	7439-97-6	0.015	0.2	0.7	0.5
Aluminum	7429-90-5	40	200	2,000	500
Antimony	7440-36-0	2.6	60	3	2
Arsenic	7440-38-2	2.9	10	25	5
Barium	7440-39-3	13	200	1,000	200
Beryllium	7440-41-7	0.88	5	NL	NL
Cadmium	7440-43-9	0.63	5	5	1
Calcium	7440-70-2	430	5000	NL	NL
Chromium	7440-47-3	0.49	10	50	10
Cobalt	7440-48-4	1.1	50	NL	NA
Copper	7440-50-8	2.9	25	200	40
Iron	7439-89-6	15	100	300	100
Lead	7439-92-1	2.3	10	25	5
Magnesium	7439-95-4	240	5000	NL	NA
Manganese	7439-96-5	0.71	15	300	60
Nickel	7440-02-0	1.2	40	100	40
Potassium	7440-09-7	150	5000	NL	NA
Selenium	7782-49-2	4.5	35	10	7
Silver	7440-22-4	1.6	10	50	30
Sodium	7440-23-5	100	5000	20,000	5,000
Thallium	7440-28-0	3	25	NL	NA
Vanadium	7440-62-2	2.4	50	NL	NA
Zinc	7440-66-6	1.4	60	5,000	500

Project action levels are from NYSDEC Surface and Groundwater Quality Standards March 28, 2003
Method reporting limit for ISM01.2
ug/L – micrograms per liter

QAPP Worksheet #15c
Reference Limits and Evaluation Table – Water

Analyte/Method	CAS Number	Lab Method Detection Limit Water (mg/L) (Typical)	Method Reporting Limit (mg/L)	Project Quantitation Limit Water (mg/L)	Project Action Level Water (mg/L)
Alkalinity	N/A	0.1 - 5.0	TBD	N/A	N/A
Sulfate	N/A	0.0001 - 0.030	TBD	10.0	250
Chloride	N/A	0.05 – 1.0	TBD	5.0	250
Fluoride	N/A	0.01 – 0.2	TBD	0.8	3
Ammonia	N/A	0.02 – 0.05	TBD	0.2	2
Ferrous Iron	N/A	0.03	TBD	0.1	0.6
Hardness	N/A	1.0	TBD	1.0	N/A
TDS	N/A	0.01 – 4.0	TBD	10.0	500
TKN	N/A	0.1 – 0.3	TBD	1.0	10
TOC	N/A	1.0	TBD	1.0	N/A
TSS	N/A	0.004	TBD	1.0	N/A
pH	N/A	2 – 12 SU	TBD	N/A	5.1 to 8.5 SU

Project action levels are from NYSDEC Surface and Groundwater Quality Standards March 28, 2003
mg/L – milligrams per liter
N/A – Not Applicable
TBD – To Be Determined
SU – Standard Units

QAPP Worksheet #15d
Reference Limits and Evaluation Table – Air

Analyte/Method	CAS Number	Lab Method Detection Limit Air (ppbv)	Method Reporting Limit (ppbv)	Project Quantitation Limit Air (ppbv)	Project Action Level Air (ppbv)
Dichlorodifluoromethane	75-71-8	0.5	0.012	0.5	N/A*
1,2-Dichlorotetrafluoroethane	76-14-2	0.2	0.012	0.5	N/A*
Chloromethane	74-87-3	0.5	0.021	0.5	218,600*
Vinyl chloride	75-01-4	0.2	0.025	0.5	N/A*
1,3-Butadiene	106-99-0	0.2	0.027	0.5	N/A*
Bromomethane	74-83-9	0.2	0.014	0.5	N/A*
Chloroethane	75-00-3	0.5	0.1	0.5	N/A*
Trichlorofluoromethane	75-69-4	0.2	0.05	0.5	N/A*
1,1-Dichloroethene	75-35-4	0.2	0.015	0.5	91,300*
Acetone	67-64-1	5	0.99	0.5	N/A*
Isopropyl alcohol	67-63-0	5	0.043	0.5	N/A*
Carbon disulfide	75-15-0	0.5	0.05	0.5	N/A*
Methylene Chloride	75-09-2	0.5	0.03	0.5	N/A*
Methyl tert-butyl ether	1634-04-4	0.2	0.013	0.5	N/A*
trans-1,2-Dichloroethene	156-60-5	0.2	0.05	0.5	N/A*
n-Hexane	110-54-3	0.2	0.023	0.5	N/A*
1,1-Dichloroethane	75-34-3	0.2	0.013	0.5	800*
Methyl Ethyl Ketone	78-93-3	0.5	0.064	0.5	N/A*
cis-1,2-Dichloroethene	156-59-2	0.2	0.05	0.5	81,400*
Chloroform	67-66-3	0.2	0.05	0.5	46*
Tetrahydrofuran	109-99-9	5	0.1	0.5	N/A*
1,1,1-Trichloroethane	71-55-6	0.2	0.05	0.5	1,000.000*
Cyclohexane	110-82-7	0.2	0.012	0.5	N/A*
Carbon tetrachloride	56-23-5	0.2	0.05	0.5	N/A*
Benzene	71-43-2	0.2	0.05	0.5	N/A*
1,2-Dichloroethane	107-06-2	0.2	0.015	0.5	N/A*
n-Heptane	142-82-5	0.2	0.027	0.5	N/A*
Trichloroethene	79-01-6	0.2	0.014	0.5	480*

QAPP Worksheet #15d
Reference Limits and Evaluation Table – Air

Analyte/Method	CAS Number	Lab Method Detection Limit Air (ppbv)	Method Reporting Limit (ppbv)	Project Quantitation Limit Air (ppbv)	Project Action Level Air (ppbv)
1,2-Dichloropropane	78-87-5	0.016	0.2	0.5	N/A*
Bromodichloromethane	75-27-4	0.05	0.2	0.5	N/A*
cis-1,3-Dichloropropene	10061-01-5	0.05	0.2	0.5	N/A*
methyl isobutyl ketone	108-10-1	0.064	0.5	0.5	N/A*
Toluene	108-88-3	0.05	0.2	0.5	N/A*
trans-1,3-Dichloropropene	10061-02-6	0.064	0.2	0.5	N/A*
1,1,2-Trichloroethane	79-00-5	0.05	0.2	0.5	N/A*
Tetrachloroethene	127-18-4	0.017	0.2	0.5	760*
Methyl Butyl Ketone (2-Hexanone)	591-78-6	0.028	0.5	0.5	N/A*
Dibromochloromethane	124-48-1	0.05	0.2	0.5	N/A*
1,2-Dibromoethane	106-93-4	0.012	0.2	0.5	N/A*
Chlorobenzene	108-90-7	0.05	0.2	0.5	N/A*
Ethylbenzene	100-41-4	0.014	0.2	0.5	N/A*
m,p-Xylene	108-38-3 106-42-3	0.023	0.5	0.5	N/A*
o-Xylene	95-47-6	0.05	0.2	0.5	N/A*
Xylene (total)	1330-20-7	0.15	0.2	0.5	N/A*
Styrene	100-42-5	0.05	0.2	0.5	N/A*
Bromoform	75-25-2	0.05	0.2	0.5	N/A*
Cumene	98-82-8	0.05	0.2	0.5	N/A*
1,1,2,2-Tetrachloroethane	79-34-5	0.05	0.2	0.5	N/A*
n-Propylbenzene	103-65-1	0.064	0.2	0.5	N/A*
4-Ethyltoluene	622-96-8	0.064	0.2	0.5	N/A*
1,3,5-Trimethylbenzene	108-67-8	0.064	0.2	0.5	N/A*
1,2,4-Trimethylbenzene	95-63-6	0.064	0.2	0.5	N/A*
1,3-Dichlorobenzene	541-73-1	0.018	0.2	0.5	N/A*
1,4-Dichlorobenzene	106-46-7	0.021	0.2	0.5	N/A*
Benzyl chloride	100-44-7	0.022	0.2	0.5	N/A*

QAPP Worksheet #15d
Reference Limits and Evaluation Table – Air

Analyte/Method	CAS Number	Lab Method Detection Limit Air (ppbv)	Method Reporting Limit (ppbv)	Project Quantitation Limit Air (ppbv)	Project Action Level Air (ppbv)
1,2-Dichlorobenzene	95-50-1	0.017	0.2	0.5	N/A*
1,2,4-Trichlorobenzene	120-82-1	0.032	0.5	0.5	N/A*
Hexachlorobutadiene	87-68-3	0.022	0.2	0.5	N/A*

Project action levels are from NYSDEC, Division of Air Resources, Air Guide 1 program

Method reporting limit for TO-15

ppbv – parts per billion by volume

N/A – Not Applicable

* Will be finalized when the air permit is received

QAPP Worksheet #15e
Reference Limits and Evaluation Table – VOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
1,1,1-Trichloroethane	71-55-6	0.2	5	240	Refer to Appendix A
1,1,2,2-Tetrachloroethane	79-34-5	1	5	180	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.1	5	1,800	
1,1,2-Trichloroethane	79-00-5	0.36	5	NL	
1,1-Dichloroethane	75-34-3	0.29	5	60	
1,1-Dichloroethene	75-35-4	0.31	5	120	
1,2,3-Trichlorobenzene	87-61-6	0.19	5	NL	
1,2,4-Trichlorobenzene	120-82-1	0.29	5	1,020	
1,2-Dibromo-3-chloropropane	96-12-8	0.34	5	NL	
1,2-Dichlorobenzene	95-50-1	0.084	5	2,370	
1,2-Dichloroethane	107-06-2	1	5	30	
1,2-Dichloropropane	78-87-5	0.4	5	NL	
1,3-Dichlorobenzene	541-73-1	0.095	5	480	
1,4-Dichlorobenzene	106-46-7	0.18	5	2,550	
2-Butanone	78-93-3	1.6	10	90	
2-Hexanone	591-78-6	2.8	10	NL	
4-Methyl-2-pentanone	108-10-1	0.66	10	300	
Acetone	67-64-1	1.1	10	60	
Benzene	71-43-2	0.3	5	18	
Bromochloromethane	74-97-5	0.35	5	NL	
Bromodichloromethane	75-27-4	1	5	NL	
Bromoform	75-25-2	1	5	NL	
Bromomethane	74-83-9	0.79	5	NL	
Carbon disulfide	75-15-0	0.21	5	810	
Carbon tetrachloride	56-23-5	0.2	5	180	
Chlorobenzene	108-90-7	0.11	5	510	
Chloroethane	75-00-3	0.49	5	570	
Chloroform	67-66-3	0.27	5	90	

QAPP Worksheet #15e
Reference Limits and Evaluation Table – VOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Chloromethane	74-87-3	0.69	5	NL	Refer to Appendix A
cis-1,2-Dichloroethene	156-59-2	0.21	5	NL	
cis-1,3-Dichloropropene	10061-01-5	0.25	5	NL	
Cyclohexane	110-82-7	0.64	5	NL	
Dibromochloromethane	124-48-1	0.16	5	NL	
Dichlorodifluoromethane	75-71-8	0.21	5	NL	
Ethylbenzene	100-41-4	0.11	5	1,650	
Isopropylbenzene	98-82-8	0.13	5	NL	
m,p-Xylene	108-38-3 106-42-3	0.18	5	360	
Methyl acetate	79-20-9	0.35	5	NL	
Methyl tert-butyl ether	1634-04-4	0.18	5	NL	
Methylcyclohexane	108-87-2	0.24	5	NL	
Methylene chloride	75-09-2	0.32	5	30	
o-Xylene	95-47-6	0.11	5	360	
Styrene	100-42-5	0.13	5	NL	
Tetrachloroethene	127-18-4	0.14	5	420	
Toluene	108-88-3	0.21	5	450	
trans-1,2-Dichloroethene	156-60-5	0.22	5	90	
trans-1,3-Dichloropropene	10061-02-6	0.22	5	NL	
Trichloroethene	79-01-6	0.23	5	210	
Trichlorofluoromethane	75-69-4	0.25	5	NL	
Vinyl chloride	75-01-4	0.29	5	60	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for SOM01.2
ug/Kg – micrograms per kilogram
NL – Not Listed

QAPP Worksheet #15f
Reference Limits and Evaluation Table – SVOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
1,1'-Biphenyl	92-52-4	13	170	NL	Refer to Appendix A
1,2,4,5-Tetrachlorobenzene	95-94-3	14	170	NL	
2,2'-Oxybis(1-chloropropane)	108-60-1	18	170	NL	
2,3,4,6-Tetrachlorophenol	58-90-2	13	170	NL	
2,4,5-Trichlorophenol	95-95-4	15	170	100	
2,4,6-Trichlorophenol	88-06-2	14	170	NL	
2,4-Dichlorophenol	120-83-2	22	170	170	
2,4-Dimethylphenol	105-67-9	9.4	170	NL	
2,4-Dinitrophenol	51-28-5	45	330	330	
2,4-Dinitrotoluene	121-14-2	22	170	NL	
2,6-Dinitrotoluene	606-20-2	18	170	200	
2-Chloronaphthalene	91-58-7	16	170	NL	
2-Chlorophenol	95-57-8	14	170	170	
2-Methylnaphthalene	91-57-6	14	170	7280	
2-Methylphenol	95-48-7	20	170	170	
2-Nitroaniline	88-74-4	29	330	330	
2-Nitrophenol	88-75-5	17	170	170	
3,3'-Dichlorobenzidine	91-94-1	100	170	NL	
3-Nitroaniline	99-09-2	37	330	330	
4,6-Dinitro-2-methylphenol	534-52-1	56	330	NL	
4-Bromophenyl-phenylether	101-55-3	16	170	NL	
4-Chloro-3-methylphenol	59-50-7	16	170	170	
4-Chloroaniline	106-47-8	30	170	170	
4-Chlorophenyl-phenylether	7005-72-3	17	170	NL	
4-Methylphenol	106-44-5	16	170	180	
4-Nitroaniline	100-01-6	27	330	NL	
4-Nitrophenol	100-02-7	35	330	330	
Acenaphthene	83-32-9	14	170	10000	
Acenaphthylene	208-96-8	12	170	8200	

QAPP Worksheet #15f
Reference Limits and Evaluation Table – SVOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Acetophenone	98-86-2	20	170	NL	Refer to Appendix A
Anthracene	120-12-7	12	170	10000	
Atrazine	1912-24-9	17	170	NL	
Benzaldehyde	100-52-7	21	170	NL	
Benzo(a)anthracene	56-55-3	16	170	170	
Benzo(a)pyrene	50-32-8	18	170	170	
Benzo(b)fluoranthene	205-99-2	35	170	220	
Benzo(g,h,i)perylene	191-24-2	7.4	170	10000	
Benzo(k)fluoranthene	207-08-9	12	170	220	
Bis(2-chloroethoxy)methane	111-91-1	15	170	NL	
Bis(2-chloroethyl)ether	111-44-4	14	170	NL	
Bis(2-ethylhexyl)phthalate	117-81-7	25	170	10000	
Butylbenzylphthalate	85-68-7	24	170	10000	
Caprolactam	105-60-2	41	170	NL	
Carbazole	86-74-8	17	170	NL	
Chrysene	218-01-9	21	170	170	
Dibenzo(a,h)anthracene	53-70-3	9.1	170	170	
Dibenzofuran	132-64-9	18	170	1240	
Diethylphthalate	84-66-2	19	170	1420	
Dimethylphthalate	131-11-3	18	170	400	
Di-n-butylphthalate	84-74-2	17	170	1620	
Di-n-octylphthalate	117-84-0	20	170	10000	
Fluoranthene	206-44-0	22	170	10000	
Fluorene	86-73-7	18	170	10000	
Hexachlorobenzene	118-74-1	18	170	170	
Hexachlorobutadiene	87-68-3	18	170	NL	
Hexachlorocyclopentadiene	77-47-4	33	170	NL	
Hexachloroethane	67-72-1	19	170	NL	
Indeno(1,2,3-cd)pyrene	193-39-5	25	170	640	
Isophorone	78-59-1	18	170	880	

QAPP Worksheet #15f
Reference Limits and Evaluation Table – SVOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Naphthalene	91-20-3	17	170	2800	Refer to Appendix A
Nitrobenzene	98-95-3	20	170	170	
N-Nitroso-di-n-propylamine	621-64-7	10	170	NL	
N-Nitrosodiphenylamine	86-30-6	15	170	NL	
Pentachlorophenol	87-86-5	25	330	330	
Phenanthrene	85-01-8	17	170	10000	
Phenol	108-95-2	30	170	170	
Pyrene	129-00-0	14	170	10000	
Aniline (8270C)	62-53-3	35.7	270	100	
Benzoic acid (8270C)	65-85-0	377	1700	810	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for SOM01.2
ug/Kg – micrograms per kilogram
NL – Not Listed

QAPP Worksheet #15g
Reference Limits and Evaluation Table – Pesticides/Herbicides Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Parathion (8270C)	56-38-2	49	330	500	Refer to Appendix A
4,4'-DDD	72-54-8	0.43	3.3	580	
4,4'-DDE	72-55-9	0.39	3.3	420	
4,4'-DDT	50-29-3	1.1	3.3	420	
Aldrin	309-00-2	0.2	1.7	8.2	
alpha-BHC	319-84-6	0.25	1.7	22	
alpha-Chlordane	5103-71-9	0.18	1.7	108	
beta-BHC	319-85-7	0.34	1.7	40	
delta-BHC	319-86-8	0.25	1.7	60	
Dieldrin	60-57-1	0.39	3.3	8.8	
Endosulfan I	959-98-8	0.19	1.7	180	
Endosulfan II	33213-65-9	0.42	3.3	180	
Endosulfan sulfate	1031-07-8	0.47	3.3	200	
Endrin	72-20-8	0.41	3.3	20	
Endrin aldehyde	7421-93-4	0.41	3.3	NL	
Endrin ketone	53494-70-5	0.4	3.3	NL	
gamma-BHC (Lindane)	58-89-9	0.18	1.7	12	
gamma-Chlordane	5103-74-2	0.2	1.7	108	
Heptachlor	76-44-8	0.28	1.7	20	
Heptachlor epoxide	1024-57-3	0.2	1.7	4	
Methoxychlor	72-43-5	1.9	17	NL	
Toxaphene	8001-35-2	24	170	NL	
2,4-D	94-75-7	19	38	100	
4-Nitrophenol	100-02-7	18	36	330	

QAPP Worksheet #15g
Reference Limits and Evaluation Table – Pesticides/Herbicides Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Pentachlorophenol	87-86-5	1.9	3.8	330	Refer to Appendix A
2,4,5-T	93-76-5	4.75	9.5	380	
Silvex (2,4,5-TP)	93-72-1	1.9	3.8	300	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for SW846 8151 and SOM01.2
ug/Kg – micrograms per kilogram
NL – Not Listed

QAPP Worksheet #15h
Reference Limits and Evaluation Table – Aroclors (PCBs) Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Aroclor-1016	12674-11-2	8.3	33	200	Refer to Appendix A
Aroclor-1221	11104-28-2	8.3	33	200	
Aroclor-1232	11141-16-5	3.7	33	200	
Aroclor-1242	53469-21-9	2.5	33	200	
Aroclor-1248	12672-29-6	2.7	33	200	
Aroclor-1254	11097-69-1	8.3	33	200	
Aroclor-1260	11096-82-5	8.3	33	200	
Aroclor-1262	37324-23-5	8.3	33	200	
Aroclor-1268	11100-14-4	3.5	33	200	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for SOM01.2
ug/Kg – micrograms per kilogram
NL – Not Listed

QAPP Worksheet #15i
Reference Limits and Evaluation Table – Inorganics (Metals) Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Aluminum	7429-90-5	6.4	20	200	Refer to Appendix A
Antimony	7440-36-0	0.34	6	N/A	
Arsenic	7440-38-2	0.27	1	1.5	
Barium	7440-39-3	0.89	20	60	
Beryllium	7440-41-7	0.028	0.5	0.16	
Cadmium	7440-43-9	0.033	0.5	0.5	
Calcium	7440-70-2	7.9	500	N/A	
Chromium	7440-47-3	0.046	1	2	
Cobalt	7440-48-4	0.077	5	6	
Copper	7440-50-8	0.097	2.5	5	
Iron	7439-89-6	1.4	10	400	
Lead	7439-92-1	0.26	1	50	
Magnesium	7439-95-4	6.7	500	N/A	
Manganese	7439-96-5	0.024	1.5	50	
Nickel	7440-02-0	0.22	4	4	
Potassium	7440-09-7	19	500	N/A	
Selenium	7782-49-2	0.28	3.5	2	
Silver	7440-22-4	0.15	1	8	
Sodium	7440-23-5	6	500	N/A	
Thallium	7440-28-0	0.13	2.5	N/A	
Vanadium	7440-62-2	0.12	5	30	
Zinc	7440-66-6	0.85	6	6	
Mercury	7439-97-6	N/A	0.1	0.1	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for ISM01.2
mg/Kg – milligrams per kilogram
N/A – Not Applicable
NL – Not Listed

QAPP Worksheet #16
Project Schedule Timeline Table

Figure 2 Presents the Project Schedule

QAPP Worksheet # 17 Sampling Design and Rationale

Arrowhead's portion of the RA will include completion of the wellheads for the extraction wells, installation of yard piping connecting the extraction wells to a treatment system and from the treatment system to a surface discharge point, construction of a groundwater treatment facility (GWTF), and O&M of the system. The influent to the GWTF from the extraction wells will be treated by a bag filters followed by an air stripper to reduce CVOC concentrations and remove suspended solids before discharging to a nearby surface recharge basin. The off-gas from the air stripper will be monitored for compliance with NYSDEC requirements and emitted directly to the atmosphere. Samples of the groundwater influent and effluent will be collected and analyzed as part of an Initial Test Period (ITP) to be conducted as part of start-up testing to demonstrate system performance. Sampling of the groundwater influent and effluent and off-gas will also be performed during the ITP and O&M of the GWTF system to ensure compliance with the NYSDEC SPDES discharge permit equivalent and air pollution permit equivalent.

The major elements of the Arrowhead's portion of the RA scope of work that will involve sampling and analysis are summarized below.

- Soil sampling associated with disposal of excess excavated soil and imported borrow material
- Sampling and analysis of groundwater influent and effluent and off-gas from the air stripper during the ITP
- Sampling and analysis of groundwater influent and effluent and off-gas from the air stripper O&M of GWTF

The design and rationale of the RA approach are described in detail in the following worksheets:

- Soil sampling for earthwork construction activities – Worksheet #17a
- Groundwater treatment system
 - Initial testing program – Worksheet #17b
 - Treatment system operation & maintenance – Worksheet #17c

**QAPP Worksheet #17a
Sampling Design and Rationale
Soil Sampling For Earthwork Construction Activities**

Earthwork will be performed in accordance with Contract Specification Section 02300, which includes excavation for building foundation, transformer pad, and well vaults; trenching for pipelines and appurtenance; backfilling and compaction; disposal of surplus and unsuitable material; site grading; and access road construction. Based on Arrowhead's preliminary estimate, approximately 1,800 CY of soil will be excavated as part of the earthwork. We do not anticipate the offsite disposal of any excavated soil. Soil that is found to be unsuitable for backfill (i.e. soil w/ debris) will be stockpiled and characterized for offsite disposal. Waste characterization results will be compared to DER10 criteria.

Excess/Unsuitable Excavated Material Sampling

Soil sampling conducted as part of previous Site investigation in the vicinity of the proposed yard piping and building site has not detected contamination. However, if contaminated soil is found by field screening with a PID and visual inspection for discoloration and/or odor, excess soil is generated, or unsuitable materials are excavated, samples will be collected for waste characterization. The number of samples and analyte list will be determined by the disposal facility requirements. Material not suitable for use as structural fill will be used for general site grading in open areas.

Excavated Material used for Backfill Sampling

Samples associated with the geotechnical investigation were collected to determine the suitability on on-site materials for use as structural backfill and for use in completion of the structural design of the building foundation. The geotechnical information for the building was used to assess soil bearing pressures, recommended depth of footings, recommendations for slab on grade bearing pressures, any need for over excavation of problem soils, and for concrete reinforcement design. Soil samples were collected at two boring locations within diagonal quadrants of the building footprint. Continuous 2" diameter split-spoon samples were collected at each boring location to a depth of 20 feet bgs. Soil from the upper 4 feet of the borings will be composited and used for Standard Proctor and grain size analyses. The geotechnical report recommended the removal of the upper four feet of soil at the treatment building and replacement with structural fill. This recommendation has been incorporated into the structural design of the treatment plant.

Additionally, two samples will be collected from along the yard piping trench and submitted for Standard Proctor and grain size analysis. One sample will be collected from the trench between the extraction wells and the Emergency Access Road and a second sample along the Clinton Road portion of the yard piping trench.

Imported Granular Material Sampling

All materials brought offsite to be used as fill and topsoil will be certified clean and tested to ensure they are free from chemical contamination by an offsite laboratory. A minimum of one chemical test will be performed per every 5,000 CY of each type of material to be used and no less than one test per borrow area and analyzed for the following parameters:

- TCL VOCs including benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane
- TAL metals, cyanide, and mercury

- TCL SVOCs including aniline
- TCL PCBs
- TCL Pesticides including parathion
- Herbicide (2,4,5-T, silvex, and 2,4-D)

Field procedures for this activity are detailed in:

- | | |
|-----------------|--|
| ■ TSOP 1-2 | Sample Custody |
| ■ TSOP 1-3 | Surface Soil Sampling |
| ■ TSOP 1-4 | Subsurface Soil Sampling (if required) |
| ■ TSOP 2-1 | Packaging and Shipping Environmental Samples |
| ■ TSOP 4-1 | Field Logbook Content and Control |
| ■ Worksheet 17m | Decontamination Procedures |

**QAPP Worksheet # 17b
Sampling Design and Rationale
Initial Testing Program**

An ITP will be conducted that will consist of a 14-day operational test aimed at demonstrating long-term operability of the system while confirming performance expectations with regard to the contaminant removal. All testing during the ITP will be performed using groundwater. All groundwater treated during this test will be discharged to the recharge basin. During this performance test, the quality of the effluent from the groundwater treatment system may not exceed the limits as required by the NYSDEC SPDES permit equivalent and Air Pollution Control permit equivalent. A copy of the SPDES permit is included in the project specifications.

Table 3, Worksheets #18, #19, and #30, and the following summarize the sampling and analytical requirements during the ITP testing:

Continuous Water Level Measurements

Continuous water level measurements will be collected from water level reading from data loggers installed in GWX-10019, GWX-10020, MW-01(S-I), and SVP-10 the three extraction wells (EW-1S, EW-1I, and EW-1D). Water level measurements will be collected using level transducer and will be used to ensure a set head at the extraction wells. The transducer data from the extraction will be automatically recorded by the PLC. The transducer data from the monitoring wells will be downloaded at the completion of the ITP. The data will be collected to create groundwater elevation iso-contour maps and capture zone estimates. Barometric pressure and rainfall measurements will also be obtained from a local weather station. In addition, water levels will be checked manually with water level probes to provide redundancy in data collection.

Flow Measurements

In-line flow meters will continuously record the flow rate from each extraction well and the effluent leaving the GWTF. The information will be sent to the PLC for visual display and to electronic record files.

Influent Sampling and Monitoring

Influent groundwater samples will be collected from each extraction well in operation during the first three (3) days of the ITP and then at one point in the header pipe after the flow from each extraction well is combined together during Days 5 and 10 of the ITP. Samples of the influent will be analyzed for TCL VOCs, total iron, and water quality parameters (pH, turbidity, ORP, conductivity, DO, and temperature). The volume of water in the sample port will be purged prior to sample collection. Note that Influent samples will be collected concurrently with the effluent water samples.

Process Sampling and Monitoring

Process samples will be collected from at sample port located after the EQ Tank, but before the bag filters, during the first three (3) days of the ITP and then during Days 5 and 10 of the ITP. These samples will be analyzed for TCL VOCs, total iron, and water quality parameters (pH, turbidity, ORP, conductivity, DO, and temperature). The volume of water in the sample port will be purged prior to sample collection. Note that the process samples will be collected concurrently with the influent water samples

Compliance Sampling and Monitoring

Compliance sample will be collected from a sample port located after the static mixture that immediately follows the injection point for the caustic. The samples will be collected at the same frequency as the influent samples. Each sample will be analyzed by the subcontract laboratory, Test America, for the following parameters:

- TCL VOCs
- TAL Metals
- Total suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Oil and Grease
- Nitrate and Nitrite (as N)
- Total Mercury
- Total Cyanide

An in-line probe located after the static mixture will provide continuous pH readings. Field measurement of water quality parameters (dissolved oxygen, pH, conductivity, temperature, oxidation-reduction potential, and turbidity) will also be collected with each sample collected.

The volume of water in the sample ports will be purged prior to sample collection.

An in-line probe located after the static mixture will provide continuous pH readings. Field measurement of water quality parameters (dissolved oxygen, pH, conductivity, temperature, oxidation-reduction potential, and turbidity) will also be collected with each sample collected.

The volume of water in the sample ports will be purged prior to sample collection.

Off-gas System Compliance Sampling and Monitoring

Air samples will be collected from the air stripper off-gas line in accordance with TSOP 1-8 and will be collected for VOCs via TO-15. The samples will be collected directly from the treatment system sample port using SUMMA canisters. Flow controllers are not required. Air-tight connection between the SUMMA canister and sample port shall be made using hose barbs and polyethylene tubing (or equal). Air samples will be collected once on Day 1 of the ITP and then once on Days 5 and 10 of the ITP. In addition, the off-gas ports will be screened for VOCs using a PID each time a sample is collected.

Field procedures for this activity are detailed in:

- | | |
|------------------|--|
| ▪ TSOP 1-2 | Sample Custody |
| ▪ TSOP 1-6 | Water Level Measurements |
| ▪ TSOP 1-8 | Volatile Organic Compound Air Sampling Using USEPA Method TO-15 with SUMMA® Canister |
| ▪ TSOP 1-10 | Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement |
| ▪ TSOP 2-1 | Packaging and Shipping Environmental Samples |
| ▪ Worksheet #17m | Decontamination Procedures |
| ▪ Worksheet #18 | Sampling Locations and Methods/ SOP Requirements |

QAPP Worksheet # 17c
Sampling Design and Rationale
Treatment System Operation & Maintenance

The groundwater treatment system will be operated and maintained by Arrowhead in accordance with the O&M manual. Arrowhead will be expected to maintain continuous extraction of water from the extraction wells at the set groundwater elevation in the wells as designated by CDM. The water level data collected from the site wells will be used to determine if hydraulic control is being maintained. Otherwise, the set groundwater elevation in the extraction well may be adjusted with approval from CDM. The GWTF sampling and analysis includes both system and performance/compliance monitoring.

Performance monitoring provides information /data that are used to verify that the treatment system and individual components are operating properly. The information/data will also be used to determine if operational setting refinement is necessary to optimize performance. Operational parameters will be recorded on a routine basis by process controls and by the operator, including extraction well flow rates and totalized flow, influent flow rate and totalized flow, line pressure at all gauges, blower air flow, alarm conditions, and other standard and pertinent operating parameters. Samples will be used to confirm compliance with the NYSDEC SPDES permit equivalency and Air Pollution Control permit equivalency.

System performance sampling will include collecting and analyzing samples from the influent, intermediate and effluent sample ports from the groundwater treatment system to monitor system performance. Effluent samples will be collected in accordance with NYSDEC SPDES permit equivalent and Air Pollution Control permit equivalent requirements. Manual readings of process parameters will also be collected daily to ensure proper operation of the system. The RA Subcontractor will record and maintain all standard and essential information for effective and efficient operation, maintenance, and management of the GWTF, that include but is not limited to, pH, flow rates, temperature, and pressure readings. These manual readings will be performed in accordance with O&M Manual. A summary of the sampling is provided below, in Table 4 and Worksheets #18, #19, and #30.

Continuous Water Level Measurements

Continuous water level measurements will be collected from water level reading from data loggers installed in the three extraction wells (EW-1S, EW-1I, and EW-1D). Water level measurements will be collected using level transducer and will be used to ensure a set head at the extraction wells. The transducer data from the extraction will be automatically recorded by the PLC.

Flow Measurements

In-line flow meters will continuously record the flow rate from each extraction well and the effluent leaving the GWTF. The information will be sent to the PLC for visual display and to electronic record files.

Influent Sampling and Monitoring

Influent groundwater samples will be collected a sample port located in the header pipe after the flow from each extraction well is combined. Samples for TCL VOC and Total Iron analyses will be collected monthly. Samples to be analyzed in the field for water quality parameters (pH, turbidity, ORP, conductivity, DO, and temperature) will be analyzed weekly. The volume of water in the sample port will be purged prior to sample collection. .

Compliance Sampling and Monitoring

Compliance samples of treated groundwater effluent will be collected from a sample port located after the static mixture that immediately follows

the injection point for the caustic. The frequency of sampling for each analysis will be as follows:

<u>Analysis</u>	<u>Sampling Frequency</u>
• TCL VOCs	Bimonthly
• TAL Metals	Monthly
• Total suspended Solids (TSS)	Weekly
• Total Dissolved Solids (TDS)	Weekly
• Oil and Grease	Bimonthly
• Nitrate and Nitrite (as N)	Monthly
• Total Mercury	Quarterly
• Total Cyanide	Quarterly

An in-line probe located after the static mixture will provide continuous pH readings. Field measurement of water quality parameters (dissolved oxygen, pH, conductivity, temperature, oxidation-reduction potential, and turbidity) will be performed weekly.

The volume of water in the sample ports will be purged prior to sample collection.

Off-gas System Compliance Sampling and Monitoring

Air samples will be collected from the air stripper off-gas line in accordance with TSOP 1-8 and will be collected for VOCs via TO-15. The samples will be collected directly from the treatment system sample port using SUMMA canisters. Flow controllers are not required. Air-tight connection between the SUMMA canister and sample port shall be made using hose barbs and polyethylene tubing (or equal). Air samples will be collected weekly during the first 6 months of operation and then bimonthly thereafter. In addition, the off-gas ports will be screened for VOCs using a PID each time a sample.

Field procedures for this activity are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 1-6 Water Level Measurements
- TSOP 1-8 Volatile Organic Compound Air Sampling Using USEPA Method TO-15 with SUMMA® Canister
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement
- TSOP 2-1 Packaging and Shipping Environmental Samples
- Worksheet #17m Decontamination Procedures
- Worksheet #18 Sampling Locations and Methods/ SOP Requirements

QAPP Worksheet # 17d
Sampling Design and Rationale
Waste Disposal Characterization Sampling

Waste material generated during this RA may include, but is not limited to, excavated soil determined not to be suitable for backfilling, and construction debris. In order to properly dispose the waste, the waste must first be characterized. All waste characterization sampling and field screening methods will be in accordance with disposal facility requirements and applicable federal, state, and local regulations. Wastes disposed offsite must be disposed of at an EPA-approved disposal facility. Details including handling, storage, and disposal procedures and sampling and analytical requirements for all waste generated during construction and operation, maintenance and monitoring activities will be included in the Waste Management Plan that will be prepared by Arrowhead.

Waste disposal sampling will be performed by collecting representative composite samples from each waste stream that may be potentially hazardous or as required by the EPA-approved disposal facility. Compositing scheme for solid waste samples will be approved by CDM. Waste will be stored in a designated staging area that will be located onsite. All wastes will be segregated as a result of construction and operation activities in accordance with Contract Specification 02120 – OFFSITE TRANSPORTATION AND DISPOSAL and are summarized below:

- Excavated soils identified as contaminated will be segregated as potentially hazardous waste.
- PPE, packaging and shipping materials, construction and demolition debris, and other materials not in contact with contaminated groundwater will be segregated as non-hazardous. This material will be stockpiled and covered or loaded into tarped roll-off containers. Erosion and sedimentation controls will be installed around all stockpiles.
- Wastewater from routine maintenance of the treatment facility and other sources not mixed with contaminated groundwater will be segregated as non-hazardous.
- Construction and demolition debris will be stored in roll-off containers.

Field Procedures for these Activities are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 1-3 Surface Soil Sampling
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 2-2 Guide to Handling Investigation Derived Waste
- TSOP 4-1 Field logbook Content and Control
- Worksheet #17i Decontamination Procedures

**QAPP Worksheet # 17e
Sampling Design and Rationale
Decontamination Procedures**

Decontamination Procedures:

Field decontamination will be performed on all personnel and equipment that enters the exclusion zone. Personnel decontamination procedures will be implemented to prevent worker exposure to site contaminants as explained in the site HASP prepared by the RA Subcontractor. In addition, a separate HASP will be prepared by CDM for oversight work. Decontamination procedures will be implemented to prevent cross-contamination of environmental samples and to prevent off-site migration of contaminants.

Field Monitoring Equipment - Instruments should be cleaned per manufacturer's instructions. The electronic water level indicators, pressure transducer and data logger, electronic water level indicators, and water quality parameter probes will be rinsed with clean water after each use.

Large Pieces of Equipment - All construction equipment that comes in contact with soil must be brushed prior to leaving the site to avoid tracking of these materials into the adjoining public roadways.

Sampling Apparatus – Disposable sampling equipment will be employed to the greatest extent possible. If reusable equipment is necessary all sampling apparatus must be properly decontaminated prior to its use in the field to prevent cross-contamination. Equipment should be decontaminated after usage (once a day or on an as needed basis). The required decontamination procedure for all soil sampling equipment is as follows:

- a. dry brush
- b. non-phosphate detergent rinse (brush as necessary to remove soil on equipment)
- c. tap water* rinse
- d. air dry

Field Procedures for these Activities are detailed in:

TSOP 4-5 Field Equipment Decontamination at Nonradioactive Sites

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number ¹	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Soil Sampling During Earthwork Construction Activities							
Excess/unsuitable soil/Refer to Worksheet 26	Soil	Composite from minimum 3 aliquots	TBD by requirements of disposal facility	Standard	TBD	-	See Worksheet #17a
Imported Granular Material Sampling / Refer to Worksheet 26	Soil	NA- Stockpile	Grain size analysis, Standard Proctor, TCL VOCs including benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane, TAL Metals (including mercury), TCL SVOCs including aniline, PCBs, Pesticides (including parathion), Herbicides (2,4,5-T, 2,4-D, and Silvex)	Low	1 per 5,000 CY of stockpile	TSOP 1-3	See Worksheet #17a

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number ¹	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Sampling During ITP							
Continuous water level data GWX-10019, GWX-10020, MW-01(S-1), SVP-10, EW-1S, EW-1I, and EW-1D	Groundwater	Water table	Water level data	NA	NA	TSOP 1-6	See Worksheet #17b
Influent Sampling- EW-1S, EW-1I, and EW-1D influent header/ Refer to Worksheet 26	Groundwater	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all other parameters	3 total samples; one sample per day during Days 1, 2, and 3 (zero duplicate)	NA	See Worksheet #17b
Influent Sampling- In Header Pipe / Refer to Worksheet 26	Groundwater	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all other parameters	2 total samples; one sample per day on Days 5 and 10 (Zero duplicate)	NA	See Worksheet #17b
Process Sampling after EQ Tank / Refer to Worksheet 26	Treated Groundwater ²	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all others	5 total samples; one sample from each port during Days 1, 2, 3, 5, and 10 (zero duplicate)	NA	See Worksheet #17b

Compliance Sampling after static mixer / Refer to Worksheet 26	Treated Groundwater ²	NA-Port sampling	TCL VOCs, Total Metals, TDS, TSS, Total Mercury, Total Cyanide, Oil and Grease, Nitrate/Nitrite Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all others	5 total samples; one sample from each port during Days 1, 2, 3, 5, and 10 (one duplicate)	NA	See Worksheet #17b
Off-gas System Exhaust Stack sample port	Air	NA-Port sampling	VOCs via TO-15 and PID Screening	Low	5 total samples; 1 sample per day per day; Day 1, 2, 3, 5, and 10	NA	See Worksheet #17b

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number ¹ Sampling Location/ID Number ¹	Matrix Matrix	Depth Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Sampling During O&M							
Continuous water level data EW-1S, EW-1I, and EW-1D	Groundwater ^r	Water table	Water level data	NA	NA	TSOP 1-6	See Worksheet #17b
Influent Sampling- In Header Pipe / Refer to Worksheet 26	Groundwater ^r	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all other parameters	One per month for TCL VOCs and Total Iron and once per week for water quality parameters	NA	See Worksheet #17b
Compliance Sampling after static mixer / Refer to Worksheet 26	Treated Groundwater ^{r2}	NA-Port sampling	TCL VOCs, TAL Metals, TDS, TSS, Total Mercury, Total Cyanide, Oil and Grease, Nitrate/Nitrite Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all others	VOCs – 2 per month TAL Metals – Monthly Mercury – Qtrly Cyanide – Qtrly Oil & Grease – 2 per month Nitrate/Nitrite – Monthly Water Quality Parameters - Weekly	NA	See Worksheet #17b

Off-gas System Exhaust Stack sample port/ Refer to Worksheet 26	Air	NA-Port sampling	VOCs via TO-15 and PID Screening	Low	One per week for first 6 months and then twice monthly thereafter	NA	See Worksheet #17b
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1. See Worksheet #17 for a description of the sampling activities
2. Field duplicate quantities are determined based on the total number of samples that will be collected during O&M per matrix.

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical/Preparation Method/SOP Reference ¹	Minimum Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time ⁴ (preparation/analysis)
Air	VOCs	Low	TO-15	-	SUMMA Canister – 6 L	NA	30 days
Groundwater	TCL VOCs (trace)	Trace	SOM01.2	80 ml	3 X 40 ml vials with Teflon septum	HCl to pH<2; Cool to 4 degrees C. No head space or air bubbles	10 days preserved-VTSR (14 days technical)
Groundwater	TAL metals,	Low	ISM01.2 (ICP-AES, & ICP-MS)	2 liters	2-1 liter polyethylene bottles	HNO ₃ to pH <2; Cool to 4 degrees C	178 days (180 technical); Hg: 26 days-VTSR (28 technical)
Groundwater	Total Mercury	Low	ISM01.2 (CVAA)	NA	See TAL Metals	See TAL Metals	See TAL Metals
Groundwater	Total Cyanide	Low	ISM01.2	1 liter	1- 1 liter polyethylene bottle	NaOH to pH >12; Cool to 4 degrees C	14 days
Groundwater	Oil and grease	Low	1664a	1 liter	1- 1 liter glass bottle	H ₂ SO ₄ or HCl to pH<2; Cool to 4 degrees C.	28 days
Groundwater	TDS	Low	SM 2540C	100 ml	1-250 ml polyethylene bottle	Cool to 4 degrees C	7 days
Groundwater	TSS	Low	SM 2540D	100 ml	1-250 ml polyethylene bottle	Cool to 4 degrees C	7 days
Groundwater	Nitrate/Nitrite	Low	353.2	1 liter	1- 1 liter polyethylene bottle	H ₂ SO ₄ to pH<2; Cool to 4 degrees C.	28 days

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical/Preparation Method/SOP Reference ¹	Minimum Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time ⁴ (preparation/analysis)
Soil	TCL VOCs	Low	5035A/SOM01.2	5 g each	3-40 ml pre-weighed closed system vials with spin bar (weigh the vial before and after adding the sample and record the weights on the COC)	Cool to 4 degrees C	48 hours (on ice) or 10 days (frozen)–VTSR; 40 days analyze
	Percent Moisture (include with VOC vials)	NA	SOM01.2	50 grams	(1) 4 oz. jar w/Teflon lined cap	No preservation No headspace in sample jar	Technical-48 hours
Soil	SVOCs	Low	SOM01.2	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	10 days–VTSR; 40 days analyze; Technical 14/40
Soil	Pesticides	Low	SOM01.2	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	10 days–VTSR; 40 days analyze; Technical 14/40
Soil	PCBs	Low	SOM01.2	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	10 days–VTSR; 40 days analyze; Technical 14/40
Soil	TAL Metals (including mercury and cyanide)	Low	ISM01.2	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	Metals: 178 days; Hg: 26 days; CN: 12 days VSTR
Soil	Herbicide (2,4,5-T, 2,4-D, and Silvex)	Low	SW846 8151	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	10 days–VTSR; 40 days analyze; Technical 14/40
Soil	Standard Proctor	NA	ASTM D698	3 Gallon	Bucket	NA	NA
Soil	Grain Size	NA	ASTM D421-85 ASTM D422-63	2 Gallon	Bucket	NA	NA

C	Celsius	mL	milliliter	N/A	not applicable
H ₂ SO ₄	Sulfuric Acid	PTFE	Polytetrafluoroethylene	ASTM	American Society of Testing and
Materials					
HCl	Hydrochloric Acid	VTSR	Verified Days to Sample Receipt	HNO ₃	Nitric Acid

1. SOP reference numbers are laboratory specific. This information is maintained by EPA and is not available to EPA contractors.
2. No additional volume is required for MS/MSD analyses for VOC and SVOC analysis.
The field team will consolidate the sample bottles dependent on the type of preservation and laboratories assigned to the wet chemistry analyses.
3. Holding times are from date of collection except for TCL VOC (trace), TCL and TAL analyses. These analyses holding times are from the verified time of sample receipt (VTSR).

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples ⁵	No. of Equipment Blanks	No. of Trip Blanks
Soil Sampling During Earthwork Construction Activities								
Soil – Excess/unsuitable Material Sampling	TBD by requirements of disposal facility	Standard	TBD by requirements of disposal facility	TBD	0	0	0	0
Soil - Imported Granular Material Sampling	TCL VOCs, TAL Metals (including mercury), TCL SVOCs including aniline, PCBs, Pesticides (including parathion), Herbicides (2,4,5-T, silvex, and 2,4-D)	Low	SOM01.2 ISM01.2 SW846 8151	TBD	TBD			
Groundwater Treatment System								
ITP								
Groundwater – Influent Sampling	TCL VOCs, Total Iron	Trace for VOCs, Low	SOM01.2 ISM01.2	5	1 ¹	0 ²	0	5 ³ (for VOCs only)
Groundwater – Process Sampling	TCL VOCs, Total Iron	Trace for VOCs, Low	SOM01.2 ISM01.2,	5		0 ²	0	
Groundwater treated Effluent – Compliance Sampling	TCL VOCs, TAL metals, Cyanide, Mercury, TDS, TSS, Oils and Gas and Nitrate/Nitrite	Trace for VOCs, Low	SOM01.2 ISM01.2, SM 2540C, SM 2540D, 1664a 353.2	5		1 ²	0	

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples⁵	No. of Equipment Blanks	No. of Trip. Blanks
Air – Off-gas System Sampling	VOCs	Low	TO-15	5	1 ¹	NA	NA	NA

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples ⁵	No. of Equipment Blanks	No. of Trip Blanks
Treatment System O&M (Year 1)								
Groundwater – Influent Sampling	TCL VOCs, Total Iron	Trace for VOCs, Low	SOM01.2 ISM01.2	12	1	NA	1	26 ³ (for VOCs only) NA
Groundwater – Compliance Sampling	TCL VOCs	Trace	SOM01.2	26	2	0	0	
Groundwater – Compliance Sampling	TAL Metals	Low	ISM01.2	12	1	1	1	
Groundwater – Compliance Sampling	Total Cyanide	Low	ISM01.2	4	1	1	0	
Groundwater – Compliance Sampling	Total Mercury	Low	ISM01.2	4	1	1	0	
Groundwater – Compliance Sampling	TDS, TSS	Low	SM 2540C SM 2540D	52	3	0	1	
Groundwater – Compliance Sampling	Oil and Grease	Low	1664a	26	2	0	0	
Groundwater – Compliance Sampling	Nitrate/Nitrite	Low	353.2	39	2	0 ²	0	
Air – Off-gas Compliance Sampling	VOCs	Low	TO-15	39	2	NA	NA	

1. Field duplicate quantities are determined based on the total number of samples that will be collected during ITP activity per matrix.
2. Extra volume will be collected for QC. The number of QC analysis will be shared based on the total number of samples that will be collected during ITP activity per matrix, a minimum of 1 per 20 primary samples
3. Number of trip blanks was determined based on the total number days/shipments VOC samples will be shipped during the ITP activity.
4. Field duplicate quantities are determined based on the total number of samples that will be collected during O&M activity per matrix.
5. Extra volume will be collected for QC. The number of QC analysis will be shared based on the total number of samples that will be collected during O&M per matrix, a minimum of 1 per 20 primary samples.
6. Number of trip blanks was determined based on the total number days/shipments VOC samples will be shipped during O&M.
7. Additional volume will be collected.

*No field quality control associated with the field measurement.

**As required determined by the RA Subcontractor

QAPP Worksheet #21
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
1-2	Sample Custody, Rev. 5, 3/31/07	CDM	NA	Y	-Sample tags are not required. --Distribution of COCs as per EPA Region 2 guidelines -Use waterproof ink for any handwritten labels.
1-3	Surface Soil Sampling	CDM		Y	See note 1
1-6	Water Level Measurement, Rev. 6, 3/31/07	CDM	Section 4 of TSOP	N	
1-8	Volatile Organic Compound Air Sampling using USEPA Method TO-15 with SUMMA Canister	CDM		N	
1-9	Tap Water Sampling	CDM		Y	Only Section 5 – 5, 6, 10, 12 and 13 applies
1-10	Field Measurement of Organic Vapors, Rev. 4, 3/31/07	CDM	Section 4 of TSOP Mini-RAE	N	
2-1	Packaging and Shipping Environmental Samples, Rev. 3, 3/31/07	CDM	Section 1.3 of TSOP	Y	-Methanol will not be used. -Vermiculite shall not be used.
3-1	Geoprobe® Sampling, Rev. 5, 3/31/07	CDM		N	
3-5	Lithologic Logging	CDM		N	

**QAPP Worksheet #21
Project Sampling SOP References Table**

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
4-1	Field Logbook Content and Control, Rev. 6, 3/31/07	CDM	NA	Y	Logbook notes should include decon procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/PM/Project Geologist. Details of samples collected including CLP numbers and visual observations.
4-2	Photographic Documentation of Field Activities, Rev. 7, 3/31/07	CDM	Camera	N	
4-5	Field Equipment Decontamination at Nonradioactive Sites, Rev. 7, 3/31/07	CDM	Section 4 of TSOP	Y	See Worksheet #17i -Use phthalate-free gloves
4-10	Borehole and Well Decommissioning	CDM		N	
5-1	Control of Measurement and Test Equipment, Rev. 8, 3/31/07	CDM	NA	Y	Leased or rented equipment only to be used.
Appendix A	Site-Specific Low Flow Groundwater Purging And Sampling Procedure	CDM	Section IV of SOP	N	
Contract Specification 01550	Surveying	CDM		N	

Notes:

1. Homogenization – The process of mixing individual grab samples in order to minimize the bias in sample representativeness introduced by the natural stratification of constituents within the sample. Homogenization of soil is accomplished by thoroughly mixing the collected soil with a

stainless steel spoon or spatula in the following manner. The soil should be scraped from the stainless steel container sides, corners, and bottom, then rolled into the middle and initially mixed. The soil is then quartered and moved to the four quarters of the container. Each quarter of the sample should be mixed individually, then rolled to the center of the stainless steel container and mixed again.

Method for Collecting Surface Soil Samples for VOC Analysis in Closed-System Vials

1. Use the appropriate decontaminated stainless steel or Teflon sampling device to collect the sample.
2. Retrieve the sampling device and slowly decant off any liquid phase.
3. Complete the sample label by filling in the appropriate information. Do not cover the label with tape.
4. Place the tared or pre-weighed, pre-labeled 40-ml VOA vial and cap on the scale.
5. With the aid of a clean stainless steel spatula, quickly add 5 grams of soil to the vial.
6. Immediately secure the Teflon-lined cap on the sample container.
7. Repeat the procedure for the remaining two vials.
8. Collect percent moisture sample in a 40-ml VOA vial or 60-ml jar with Teflon sealed cap. Fill the entire sample container with soil, no headspace.
9. Store samples at 4 degrees Celsius, and ship the sample to the analytical laboratory. The sample must be received by the laboratory within 48 hours of sample collection.

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Mini RAE Dual PID Toxic Gas Monitor with 11.7 eV lamp	Calibration checked at the beginning and end of day	As needed in field; semi-annually by supplier	Measure known concentration of Isobutylene 100 ppm (calibration gas)	Upon receipt, Successful operation	Calibrate am, check pm	$\pm 10\%$ of the calibrated value	Manually zero meter or service as necessary and recalibrate	Arrowhead	Manufacturer's specifications
Water Quality Meter	Calibrate at the beginning of the day and check calibration at the end of the day	Performed before shipment and as needed	Measure solutions with known values (National Institute for Standards and Technology (NIST) traceable buffers and conductivity calibration solutions)	Upon receipt, Successful operation	Daily, before each use	pH: ± 0.05 Specific Conductivity: ± 5 micro Siemens (μS) DO ± 0.02 ppm Temp.: $\pm 0.3^{\circ}C$	Recalibrate or service as necessary	Arrowhead	Manufacturer's specifications
Turbidity Meter	Calibrate daily before each use	As needed	Measure solutions with known turbidity standards	Upon receipt, Successful operation	Daily prior to use	N/A (instrument zeroed)	Manually zero or service as necessary and recalibrate	Arrowhead	Manufacturer's specifications

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Continuous Water Logger	Manufacture Calibration only	Performed by manufacture or prior to shipping	Manufacture Calibration only	Check instrument is in working order	Performed by manufacture or prior to shipping	Pass/Fail	Return to vendor or rental company for replacement	Arrowhead	Manufacturer's specifications
Water Level Meter	N/A	None	Check daily, before each use	Check instruments are in working order	Check daily before each use	Pass/Fail	Return to rental company for replacement	Arrowhead	Manufacturer's specifications
pH Meter	Daily buffer checks (2 point bracketing sample pH)	None	Recheck; replace buffer solutions and recheck. If still fails perform instrument check or place out of service	Check instruments are in working order	Check daily before each use	± 0.1 pH units or ± 0.05 pH units	Return to rental company for replacement	Arrowhead	Manufacturer's specifications

Note:

Equipment model determined by Arrowhead and approved by CDM
All sampling equipment will be supplied by Arrowhead
Permanent transducers will be government owned property.

QAPP Worksheet #23
Analytical SOP References Table

Reference Number(1)	Title, Revision, Date, and/or No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Project Work Modified (Y/N)
SOM01.2	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis; April 2007 amendment	Definitive	TCL VOCs Trace for groundwater Low for Soil	GC/MS	Test America	Y, Add benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane for imported granular material sampling
SOM01.2	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis; April 2007 amendment	Definitive	TCL SVOCs	GC/MS	Test America	Y, Add aniline
SOM01.2	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis; April 2007 amendment	Definitive	TCL Pesticides	GC/ECD	Test America	Y, Add parathion
SOM01.2	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis; April 2007 amendment	Definitive	TCL PCBs	GC/ECD	Test America	N
ISM01.2	CLP SOW for Multi-Media, Multi-Concentration Inorganic Analysis; January, 2010	Definitive	TAL Metals	ICP-AES / ICP-MS	Test America	N
ISM01.2	CLP SOW for Multi-Media, Multi-Concentration Inorganic Analysis; January, 2010	Definitive	Mercury	CVAA	Test America	N

QAPP Worksheet #23
Analytical SOP References Table

Reference Number(1)	Title, Revision, Date, and/or No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Project Work Modified (Y/N)
ISM01.2	CLP SOW for Multi-Media, Multi-Concentration Inorganic Analysis; January, 2010	Definitive	Cyanide	Spectrometer	Test America	N
TO-15	Compendium Method TO-15	Definitive	VOC	GC/MS	Test America	N
SM 2540C	MCAWW. Revised 1992	Definitive	TDS	Balance, oven	Test America	N
SM 2540D	MCAWW. Revised 1992	Definitive	TSS	Balance, oven	Test America	N
1664a	revision A (February 1999): N-HEXANE EXTRACTABLE MATERIAL (HEM; OIL AND GREASE) AND SILICA GEL TREATED N-HEXANE EXTRACTABLE MATERIAL (SGTHEM; NON-POLAR MATERIAL) BY EXTRACTION AND GRAVIMETRY	Definitive	Oil and Gas	Balance, oven	Test America	N
353.2	Revision 2 (August 1993): DETERMINATION OF NITRATE-NITRITE NITROGEN BY AUTOMATED COLORIMETRY	Definitive	Nitrate/Nitrite	Flow Injection Analyzer	Test America	N
ASTM D698	Standard Practice for Dry Preparation of Soil Samples. 2002	Definitive	Standard Proctor	Compaction Molds	Subcontractor laboratory	N
ASTM D421-85	Standard Practice for Dry Preparation of Soil Samples. 2002	Definitive*	Grain Size	Sieves, hydrometer	Subcontractor laboratory	N
ASTM D422-63	Standard Test Method for Particle-Size Analysis of Soils. 2002	Definitive*	Grain Size	Sieves, hydrometer	Subcontractor laboratory	N

QAPP Worksheet #23
Analytical SOP References Table

Reference Number(1)	Title, Revision, Date, and/or No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Project Work Modified (Y/N)
8151	Chlorinated Herbicides by GC using Methylation or Pentafluorobenzoylation Derivation, Rev 1, December 1996	Definitive	Herbicides	GC	Test America	N
8141	Organophosphorus Compounds by Gas Chromatography: Capillary Column Technique, Rev 1, September 1994	Definitive	Parathion	GC	Test America	N

1. Arrowhead Subcontractor's laboratory specific SOPs will be submitted under separate cover.

*Data will not be validated.

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Instruments used for TO-15 follow the calibration frequencies outlined in the selected laboratory's method SOP.						
GC/MS	See TO-15 Initial calibration (ICAL):	Upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met.	Relative response factor (RRF) ≥ 0.01 for 2-butanone; carbon disulfide; chloroethane; chloromethane; 1,2-dibromoethane; 1,2-dichloropropane; 1,2-dibromo-3-chloropropane; and methylene chloride. For all other compounds, RRF $\geq 0.05^*$; Percent relative standard deviation (%RSD) must be $\leq 30\%^*$. Area response at each calibration level within $\pm 40\%$ of the mean.*	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate.	Laboratory GC/MS Technician	TO-15
	Continuing calibration:	Following initial calibration verification, once every 12 hours, end of run.	RRF ≥ 0.01 for 2-butanone; carbon disulfide; chloroethane; chloromethane; 1,2-dibromoethane; 1,2-dichloropropane; 1,2-dibromo-3-chloropropane; and	Inspect system, recalibrate the instrument, and reanalyze samples.		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			<p>methylene chloride. For all other compounds, RRF $\geq 0.05^*$;</p> <p>Percent difference (%D) within $\pm 30\%^*.$</p>			
	GC/MS Tuning:	Tune with 4-Bromofluorobenzene (BFB): Beginning of each 12 hour period during which standards and samples are analyzed.	See ion abundance table (Table 3) in TO-15.	Inspect the system, identify problem. MS tune criteria must be met before calibration		
	Retention Time Evaluation:	Each analysis.	Relative retention time (RRT) must be within 0.06 RRT units of mean RRT from ICAL.*	Re-calibrate and verify, re-analyze samples back to the last good calibration check verification		

*Refer to method TO-15 and/or EPA Region II SOP HW-31.

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS VOCs See SOM01.2	Initial calibration (ICAL): 5 point standards	Upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met.	RRF ≥ 0.05 (≥ 0.01 for poor responders and DMCs); %RSD for all target compounds $\leq 30\%$ ($\leq 40\%$ for poor responders and $\leq 50\%$ for 1,4-dioxane) or correlation coefficient > 0.995 if alternate curve is used.	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate.	Laboratory GC/MS Technician	SOM01.2
	Continuing calibration verification (CCV)	Once every 12 hours; opening and closing CCVs must be run within same 12 hours	RRF ≥ 0.05 (≥ 0.01 for poor responders and DMCs); %D $\leq 30\%$ ($\leq 40\%$ for poor responders).	Inspect system; correct problem; recalibrate the instrument, reanalyze samples and standards.		
	Calibration Standards Verification	Each lot of standards	As per lab established control limits	Inspect system; correct problem; re-run standard and affected samples		
	Tuning	Daily: every 12 hours	Must meet method-specified abundance criteria.	Inspect system; correct problem; re-run standard and affected samples		
GC/MS SVOCs See SOM01.2	Initial calibration: 5 point standards	Upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column	RRF ≥ 0.05 (≥ 0.01 for poor responders); %RSD for all target compounds $\leq 20\%$ ($\leq 40\%$ for poor responders) or correlation coefficient $>$	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-	Laboratory GC/MS Technician	SOM01.2

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
		replacement, etc.), or if the continuing calibration acceptance criteria have not been met.	0.995 if alternate curve is used.	calibrate.		
	Continuing calibration (CCV)	Once every 12 hours; opening and closing CCVs must be run within same 12 hours	RRF ≥ 0.05 (≥ 0.01 for poor responders); %D $\leq 25\%$ ($\leq 40\%$ for poor responders).	Inspect system; correct problem; recalibrate the instrument, reanalyze samples and standards.		
	Calibration Standards Verification	Each lot of standards	As per lab established control limits	Inspect system; correct problem; re-run standard and affected samples		
	Tuning	Daily: every 12 hours	Must meet method-specified abundance criteria and tailing factor criteria.	Inspect system; correct problem; re-run standard and affected samples		
GC/ECD Pests See SOM01.2	Initial calibration	Upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met.	PEM resolution between two adjacent peaks $\geq 60.0\%$, single components $\geq 90.0\%$ resolved, RTs within the RT window (refer to SOM01.2), %Breakdown for DDT and endrin must be $\leq 20\%$; combined breakdown for DDR and endrin must be $\leq 30\%$. %RSD of CFs for each	Inspect the system (e.g., change the column, bake out the detector, clean the injection port); correct problem, re-calibrate.	Laboratory GC/ECD Technician	SOM01.2

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			<p>compound must be: <20% for single component target compounds except alpha-BHC and delta-BHC; <25% for alpha-BHC and delta-BHC; <30% for toxaphene and surrogates.</p> <p>Peaks used for quantitation must be >10% and <100% of full scale.</p> <p>RTs within RT windows determined from ICAL (including surrogates).</p>			
	Instrument Blank and Continuing Calibration Verification	Once every 12 hours	<p>PEM resolution between two adjacent peaks $\geq 60.0\%$, single components $\geq 90.0\%$ resolved, RTs within the RT window (refer to SOM01.2) and %D for SCP compounds and surrogates must be $\geq -25\%$ and $\leq +25\%$,</p> <p>%Breakdown for DDT and endrin must be $\leq 20\%$; combined breakdown for DDR and endrin must be $\leq 30\%$.</p>	Inspect system, recalibrate the instrument, and reanalyze samples.		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			<p>No target compound concentration > the CRQL and surrogate RTs within RT windows determined from ICAL for instrument blank.</p> <p>%D for each compound CF must be $\geq -20\%$ and $\leq +20\%$.</p> <p>RTs within RT windows determined from ICAL (including surrogates).</p>			
GC/ECD PCBs See SOM01.2	Initial calibration	Upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met.	<p>%RSD of CFs for three to five peaks for each aroclor must be <20%.</p> <p>Peaks used for quantitation must be >50% and <100% of full scale.</p> <p>RTs within RT windows determined from ICAL (including surrogates).</p>	Inspect the system (e.g., change the column, bake out the detector, clean the injection port); correct problem, re-calibrate.	Laboratory GC/ECD Technician	SOM01.2
	Instrument Blank and Continuing Calibration Verification	Once every 12 hours	No target compound concentration > the CRQL and surrogate RTs within RT windows determined from ICAL for instrument blank.	Inspect system, recalibrate the instrument, and reanalyze samples.		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			%D for the CFs for each of the aroclor peaks used must be $\leq 15\%$ for beginning CCV and $\leq 50\%$ for ending CCV. RTs within RT windows determined from ICAL (including surrogates).			
GC/ECD Herbs See SOM01.2	Initial calibration	Upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met.	Check standard surrogate recovery must be $>50\%$ and resolution must be $>60\%$. %RSD of the CFs for three to five aroclor peaks must be $\leq 20\%$. RTs within RT windows determined from ICAL (including surrogates).	Inspect the system (e.g., change the column, bake out the detector, clean the injection port); correct problem, re-calibrate.	Laboratory GC/ECD Technician	SOM01.2

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Instrument Blank and Continuing Calibration Verification	Once every 12 hours	<p>No target compound concentration > the CRQL and surrogate RTs within RT windows determined from ICAL for instrument blank.</p> <p>%D for the CFs for each of the compounds must be $\leq 25\%$.</p> <p>RTs within RT windows determined from ICAL (including surrogates).</p>	Inspect system, recalibrate the instrument, and reanalyze samples.		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-AES / ICP-MS	See ISM01.2; as per instrument manufacturer's recommended procedures	Initial calibration: daily or once every 24 hours and each time the instrument is set up.	ICP-AES: As per instrument manufacturer's recommended procedures, with at least 2 standards.	Inspect the system, correct problem, re-calibrate, and re-analyze samples.	Laboratory ICP-AES / ICP-MS Technician	ISM01.2
	Initial calibration	Daily; after tuning and optimizing instrument	Correlation coefficient >0.995 with a minimum of 3 standards and a blank	Repeat analysis; re-prepare calibration standards and reanalyze		
	ICV	Before sample analysis	90-110% recovery; source of standard separate from calibration standards	Re-calibrate instrument; prepare fresh ICV standards; do not analyze samples until problem is corrected		
	Reporting Limit Standard	After initial calibration verification standard	70-130% recovery	Re-analyze failed standard		
	CCV	Beginning and end of run; every 10 samples or every 2 hours during an analysis run, whichever is more frequent	90-110% recovery; source of standard separate from calibration standards	Re-check; re-calibrate and rerun all samples analyzed after last valid CCV		
CV-GAS	Calibration; 3 point	After instrument set up	$R^2 \geq 0.995$	Inspect system; correct problem	Laboratory analyst	TBD

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	standards					
	Initial Calibration Verification (ICV)	Before sample analysis	80-120% recovery; source of standard separate from calibration standards	Do not analyze samples until problem is corrected	Laboratory analyst	TBD
	Continuing Calibration Verification	10% or every 2 hours, whichever is more frequent	80-120% recovery	Inspect system, re-calibrate and rerun associated samples	Laboratory analyst	TBD
Colorimeter ⁴	Initial Calibration; 4 - 9 point standards	Every 3 months; every 6 months for method 300. or as per lab SOP	90-110 % recovery	Re-check; re-calibrate	Lab analyst / QA officer - TBD	SM01.2
	Calibration check (Cal Check)	Every 10 samples and at end of analytical run	80-120 % recovery	Re-check; re-calibrate and rerun all samples analyzed after last valid Cal Check	Lab analyst / QA officer - TBD	353.2
Infra red or UltraViolet Spectrophotometer	Initial Calibration; 5 point standards	Every 3 months or when other unresolved QC failure occurs	90-110 % recovery	Re-check; re-calibrate	Lab analyst / QA officer - TBD	TBD
	Calibration check	Every 10 samples and at end of analytical run	80-120 % recovery	Re-check; re-calibrate and rerun all samples analyzed after last valid cal check		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Thermometer	Calibration	Quarterly; serviced annually	See instrument manual	Replace defective thermometer	Lab analyst / QA officer - TBD	TBD
Balance	Calibration verification	Daily - before use	See instrument manual	Troubleshoot as per equipment manual/call for repair Troubleshoot as per equipment manual/call for repair	Lab analyst / QA officer - TBD	TBD
	Mass check	Daily - before use	See instrument manual		Lab analyst / QA officer - TBD	
	Temperature check	Annually	± 2°C			
Oven	Serviced annually as per Manufacturer's instruction				Lab analyst / QA officer - TBD	TBD
pH meter	Daily buffer checks (2 point bracketing sample pH)	Before use/per batch; other checks as per rental company and manufacturer's recommendations	± 0.1 pH units or ± 0.05 pH units	Recheck; replace buffer solutions and recheck. If still fails perform instrument check or place out of service	Lab analyst / QA officer - TBD	TBD

1. Arrowhead's Subcontractor's laboratory, Test America, calibration and/or method SOPs will be utilized to meet calibration criteria. Specific instrument information (Manufacturer and model) is not available at this time.
2. To be determined (TBD) - Reference SOP depends on the laboratory assignment.
3. R represents the correlation coefficient

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
For the Arrowhead's lower tier laboratory, the procured laboratory's SOPs and QA manual will detail these requirements. CDM will review and approve Arrowhead's Subcontractor's laboratory, Test America, SOPs and QA manual.								
Maintenance, testing and inspection frequencies are documented in the Test America SOPs.								
GC/MS	See TO-15; as per instrument manufacturer's recommendations	See TO-15; as per instrument manufacturer's recommendations	See TO-15; as per instrument manufacturer's recommendations	See TO-15; as per instrument manufacturer's recommendations	Acceptable re-calibration; see TO-15	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	GC/MS Technician	TO-15
GC/MS	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	Acceptable re-calibration; see SOM01.2	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	GC/MS Technician	SOM01.2
GC/ECD	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	Acceptable re-calibration; see SOM01.2	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	GC/ECD Technician	SOM01.2

ICP-AES / ICP-MS	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations; check connections	As per instrument manufacturer's recommendations	Acceptable re-calibration; see ISM01.2	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	ICP-AES / ICP-MS Technician	ISM01.2
Colorimeter	Daily	Clean glassware	Per Manufacturer's Instruction			Laboratory Staff	Manufacturer's Instruction
	Semi-annually	Physical inspection	Per Manufacturer's Instruction			Laboratory Staff	Manufacturer's Instruction

QAPP Worksheet #26
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT

Sample Collection: Arrowhead will collect all samples. Sample numbers will be assigned as described below. A coding system will be used to identify each sample collected during the duration of the project. This coding system will provide a tracking record to allow retrieval of information about a particular sample and ensure that each sample is uniquely identified. Each sample is identified by a unique code which indicates the sample type, sample number, and, in some cases, sample depth. A sample numbering system is described below which provides a unique identifier for all samples that will be collected during the site field investigation. The total number and types of samples collected are detailed in Worksheet #18. Forms 2 Lite will be used for tracking all samples collected during the project.

Qualified Arrowhead personnel will perform the sample packaging. Sample packaging will follow TSOP 1-2 and TSOP 2-1 (with modifications in Worksheet #21), with the exception that: sample tags and vermiculite will not be used. Please note that due to elevated temperatures during the summer, extra ice should be placed in the cooler to ensure that the temperature requirements are met.

Coordination of Shipment (Personnel/Organization): Arrowhead

Type of Shipment/Carrier: Priority Overnight Shipping/TBD. Samples for Saturday delivery will have the airbills checked for Saturday delivery.

Soil Sampling During Earthwork Construction Activities

Excess/Unsuitable Material Sampling

Soil samples collected will be designated "WC" for waste characterization, followed by a number (assigned sequentially) and then by the sample interval in inches. Arrowhead is responsible for documenting where the soil was collected.

Imported Granular Material Sampling

The soil samples collected will be designated as "CF" for common fill, "CS" for crushed stone, "STF" for structural fill, "SLF" for select fill and "TS"

QAPP Worksheet #26 Sample Handling System

for topsoil, followed by a number (assigned sequentially) and then the date it was collected in the order of year/month/day (YYMMDD). Arrowhead is responsible for documenting where the soil was collected. For example, the first soil sample collected on April 28, 2011 for the backfill soil will be named as FILL-1-110429.

ITP and O&M Groundwater

The influent samples collected will be designated as "EW-1S", "EW-1I", or "EW-1D" or "INF" where "INF" is the combined header representing the influent and then the date of collection in the order of year/month/day (YYMMDD). For example, EW-1S-110905 represents a sample collected from the influent port of the treatment system on September 5, 2011.

The process samples collected after the EQ Tank during the ITP will be designated as "EQ" and then the date of collection in the order of year/month/day (YYMMDD). For example, EQ-1S-110905 represents a sample collected from the influent port of the treatment system on September 5, 2011.

The effluent samples collected will be designated as "EFF" representing effluent, and then the date of collection in the order of year/month/day (YYMMDD). For example, EFF-110905 represents a sample collected from the effluent port of the treatment system on September 5, 2011.

The process samples collected after the air stripper (before the bag filter) will be designated as "AS" and then the date of collection in the order of year/month/day (YYMMDD). For example, AS-090605 represents a sample collected from a sample port after the air-stripper (before the bag filter) of the treatment system on 6/5/09.

Offgas

The air samples collected will be designated as "GAC1-INF" or "GAC1-EFF" or "GAC2-EFF" then the date of sample collection. For example, an influent air sample collected from GAC1 unit on January 3, 2010 will be designated as GAC1-INF-100103.

Sample Custody and Storage (Personnel/Organization): TBD

Sample Preparation (Personnel/Organization): TBD

Sample Determinative Analysis (Personnel/Organization): TBD

SAMPLE ARCHIVING

Field Sample Storage (No. of days from sample collection): All samples will be shipped to a CLP laboratory, DESA or a RA Subcontractor Laboratory on the day of collection via priority overnight (FedEx). Samples may be hand delivered/courier depending on laboratory location. On-site tests will be performed the same day.

Sample Extract/ Digestate Storage (No. of days from extraction/digestion): Refer to Worksheet #19 for holding time requirements

Biological Sample Storage (No. of days from sample collection): Not Applicable

QAPP Worksheet #26
Sample Handling System

SAMPLE DISPOSAL

Personnel/Organization: Laboratory responsible for analysis will dispose of samples
Number of Days from Analysis: 90 days

QAPP Worksheet #27 Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Packaging will be performed according to TSOP 2-1 (with modifications in Worksheet #21). To maintain a record of sample collection transfer between field personnel, shipment, and receipt by the laboratory, the applicable sample chain-of-custody paperwork (TSOP 1-2) is completed for each shipment (i.e., cooler) of packed sample bottles or summa cannisters. The team member actually performing the sampling is personally responsible for the care and custody of the samples collected until they are transferred properly. Arrowhead will review all field sampling activities to confirm that proper custody procedures were followed during the field work. Arrowhead personnel relinquishing the sample to the courier will sign the chain of custody record.

All courier receipts and/or paperwork associated with the shipment of samples will serve as a custody record for the samples while they are in transit from the field to the laboratory. Custody seals should remain intact during this transfer.

Coolers are secured with nylon fiber tape and at least two custody seals are placed across cooler openings. Since custody forms are sealed inside the sample cooler and custody seals remain intact, commercial carriers are not required to sign the chain-of-custody form. Examples of custody seals are included in TSOP 1-2. For summa cannister shipments, the summa cannister will be shipped in a box secured with nylon fiber tape and at least two custody seals placed across the box openings. No custody seals are required on the summa cannister itself. Examples of custody seals are included in TSOP 1-2.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

A sample custodian at the laboratory will accept custody of shipped samples, and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory manager for corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. Disposal of the samples will occur only after analyses and QA/QC checks are completed. This will complete sample transfer.

It will be each laboratory's responsibility to maintain internal logbooks and records that provide a custody record throughout sample preparation and analysis. To track field samples through data handling, Arrowhead will maintain photocopies of all chain-of-custody forms.

Sample Identification Procedures:

Refer to Worksheet #26.

Chain-of-custody Procedures:

The subcontractor responsible for sampling and will follow TSOP 1-2, Sample Custody, for chain-of-custody procedures.

QAPP Worksheet #28
QC Samples Table

Duplicates: Field duplicate samples are collected and analyzed to assess the overall precision of the field sampling technique. Duplicate samples, of a similar matrix, will be collected at a rate of five percent or at least one per every 20 samples. These duplicates will be submitted "blind" to the laboratories by using sample numbers that differ from their associated environmental samples. See Worksheet #20 for duplicate quantities. Duplicate samples will be co-located.

Trip Blanks An aqueous trip blank will be prepared the laboratory for analysis of VOCs. Trip blanks are used to determine whether on site atmospheric contaminants are seeping into the sample vials, or if any cross-contamination of samples is occurring during shipment or storage of sample containers. A trip blank consists of demonstrated analyte-free water sealed in 40-ml Teflon septum vials with no headspace (including bubbles) in the vials. Trip blank water will be considered analyte-free when analysis results for VOC analysis are below CRQL. Certification of blank water quality will be kept on site and will be filed in the project files once field work is completed. A sample of the blank water lot used in the field will be submitted for confirmatory analysis.

Trip blanks are to be kept in close proximity to the samples being collected and will be maintained at 4 degrees Celsius (°C) and handled in the same manner as the other VOC samples. Preservation of trip blanks is presented on Worksheet # 19. One trip blank will be included with each daily shipment that contains aqueous samples collected for VOC analysis. Trip blanks will be analyzed by the same VOC method as the associated set of samples.

Field Blanks: One field blank will be collected for each equipment type per decontamination event and will be analyzed for the same constituents as the environmental samples. Field blanks, also known as "rinse blanks" or "equipment blanks," are used to assess the effectiveness of equipment decontamination. Field blanks will be collected before the use of the decontaminated equipment for sampling. The frequency for field blanks is one per decontamination event, not to exceed one per day, for each equipment type and for each sample matrix. Field blanks are generated by pouring demonstrated analyte-free water over or through the decontaminated sampling tool. The definition of demonstrated analyte-free water is discussed in the previous section. Field blanks will be collected in a way that will minimize potential contamination from the ambient air. The use of the same aliquot of water on all equipment associated with a particular matrix for the required analyses is permissible. However, a separate field rinse blank must be collected for each piece of equipment associated with a particular sample matrix that will be analyzed for the analyses listed in Worksheet #20. Preservation of field blanks is specified on Worksheet # 19. Field blanks will accompany the set of samples collected by the decontaminated sampling equipment and will be kept at 4°C. *On a project-specific basis field blanks may be minimized by decreasing the frequency of decontamination and using additional equipment. In this case the samples associated with the field blank will be noted in the field logbooks and sample trip report.*

QAPP Worksheet #28
QC Samples Table

Cooler Temperature Indicators

One cooler temperature indicator or "temperature blank" will be placed in each cooler containing samples (solid and aqueous, except for grain size analysis) being sent to the laboratory for analysis. The temperature blank will consist of a sample container filled with non-preserved water (potable or distilled). The container will be labeled "COOLER TEMPERATURE INDICATOR" and dated.

Matrix Spikes (see Worksheet #20 for the parameters requiring Matrix Spikes)

Matrix spikes (MS) are laboratory QC samples drawn from excess volumes of existing samples to demonstrate the accuracy of laboratory analysis. In accordance with EPA Region 2, matrix spikes will be designated on environmental samples at a rate of one per sample delivery group (SDG). This designation will be noted on the sample container labels and the sample paperwork. An SDG is defined as one of the following:

1. All samples of an analytical case if the sample number is less than 20 (including environmental duplicates and QC blanks) and if sampling is completed within 7 calendar days.
2. Each group of 20 samples within an analytical case (including environmental duplicates, but excluding QC blanks) if the number is greater than 20.
3. Each 7-day calendar day period during which samples within an analytical case are received. This period begins with the receipt of the first sample in the SDG.

Triple volume may be required for aqueous VOC matrix MS/MSD if a subcontract laboratory is being used and are not required for CLP method SOM01.2. The water quality parameters do not require extra volume unless identified on Worksheet #19 and confirmed with a non-CLP laboratory.

QAPP Worksheet #28a
QC Samples Table

Matrix	Air					
Analytical Group	VOCs					
Concentration Level	Low (ppbv)					
Sampling SOP(s)	See Worksheet #21					
Analytical Method/SOP Reference	TO-15					
Sampler's Name	TBD					
Field Sampling Organization	RA Subcontractor					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See Worksheet #20					
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify SM/ RA Subcontractor and flag field duplicate results	Laboratory Technician	Precision	±25 % RPD
Laboratory Method Blank	1 per 20 samples	No analyte >CRQL	Suspend analysis unit source recertified	Laboratory Technician	Accuracy	No analyte > CRQL
Laboratory Replicate Sample	1 per 20 samples	± 25%D	± 25%D	Laboratory Technician	Precision	± 25%RPD
Laboratory Control Sample	1 per 20 samples	±30% R	Flag outliers	Laboratory Technician	Accuracy	70-130% R

QAPP Worksheet #28bi
QC Samples Table

Matrix	Soil
Analytical Group	TCL VOCs i
Concentration Level	Low (µg/kg)
Sampling SOP(s)	See Worksheet #21
Analytical Method/SOP Reference	SOM01.2
Sampler's Name	TBD
Field Sampling Organization	Arrowhead
Analytical Organization	As per Worksheet #30
No. of Sample Locations	See Worksheet #20

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Field Duplicate	1 per 20 samples	None		Notify SM/ RA Subcontractor and flag duplicate results	Arrowhead Personnel	Precision	100% RPD ABS ≤ 5xCRQL	
Temperature Blank	1 per cooler	≤ 6 degrees Celsius		Increase coolant	Arrowhead Personnel	Accuracy	≤ 10 degrees Celsius	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Arrowhead Personnel	Accuracy / Contamination	No analyte > CRQL*	
Method Blank	1 every 12 hours	No analyte > CRQL*		Suspend analysis unit source recertified	Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*	
Matrix Spike (Not Required)	1 per ≤ 20 samples; if requested	1,1-Dichloroethene	59-172 %R	Flag outliers	Laboratory GC/MS Technician	Accuracy	1,1-Dichloroethene	59-172 %R
		Trichloroethene	62-137 %R				Trichloroethene	62-137 %R
		Benzene	66-142 %R				Benzene	66-142 %R

		Toluene	59-139 %R				Toluene	59-139 %R
		Chlorobenzene	60-133 %R				Chlorobenzene	60-133 %R
Matrix Spike Duplicate (Not Required)	1 per ≤ 20 samples; if requested	1,1- Dichloroethene	0-22 %RPD	Flag outliers	Laboratory GC/MS Technician	Precision	1,1- Dichloroethene	0-22 %RPD
		Trichloroethene	0-24 %RPD				Trichloroethene	0-24 %RPD
		Benzene	0-21 %RPD				Benzene	0-21 %RPD
		Toluene	0-21 %RPD				Toluene	0-21 %RPD
		Chlorobenzene	0-21 %RPD				Chlorobenzene	0-21 %RPD

*with the exception of methylene chloride, 2-butanone & acetone which can be up to 2 times the CRQL. (EPA CLP National Functional Guidelines, Final, July 2007)

QAPP Worksheet #28bii
QC Samples Table

Matrix	SOIL
Analytical Group	TCL VOCs [cont'd]
Concentration Level	Low (µg/kg)
Sampling SOP(s)	See Worksheet #21
Analytical Method/SOP Reference	SOM01.2
Sampler's Name	TBD
Field Sampling Organization	RA Subcontractor
Analytical Organization	As per Worksheet #30
No. of Sample Locations	See Worksheet #20

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QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Deuterated Monitoring Compounds	all samples	Vinyl chloride-d3	68-122 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet necessary limits (Section 11.3.4, Page D45 of SOM01.2)	Laboratory GC/MS Technician	Accuracy	Vinyl chloride-d3	68-122 %R
		Chloroethane-d5	61-130 %R				Chloroethane-d5	61-130 %R
		1,1-Dichloroethene-d2	45-132 %R				1,1-Dichloroethene-d2	45-132 %R
		2-Butanone-d5	20-182 %R				2-Butanone-d5	20-182 %R
		Chloroform-d	72-123 %R				Chloroform-d	72-123 %R
		1,2-Dichloroethane-d4	79-122 %R				1,2-Dichloroethane-d4	79-122 %R
		Benzene-d6	80-121 %R				Benzene-d6	80-121 %R
		1,2-Dichloropropane-d6	74-124 %R				1,2-Dichloropropane-d6	74-124 %R
		Toluene-d8	78-121 %R				Toluene-d8	78-121 %R
		trans-1,3-Dichloropropene-d4	72-130 %R				trans-1,3-Dichloropropene-d4	72-130 %R
		2-Hexanone-d5	17-184 %R				2-Hexanone-d5	17-184 %R
		1,4-Dioxane-d8	50-150 %R				1,4-Dioxane-d8	50-150 %R
		1,1,2,2-Tetrachloroethane-d2	56-161 %R				1,1,2,2-Tetrachloroethane-d2	56-161 %R
		1,2-Dichlorobenzene-d4	70-131 %R				1,2-Dichlorobenzene-d4	70-131 %R
Internal Standards	all samples	50-100% of area, ± 30 second retention time shift		Check calculations/ instruments reanalyze affected	Laboratory GC/MS Technician	Accuracy	50-100% of area, ± 30 second retention time shift	

QAPP Worksheet #28c
QC Samples Table

Matrix	Soil							
Analytical Group	TCL SVOCs including aniline							
Concentration Level	Low (µg/kg)							
Sampling SOP(s)	See Worksheet #21							
Analytical Method/SOP Reference	SOM01.2 Modified							
Sampler's Name	TBD							
Field Sampling Organization	RA subcontractor							
Analytical Organization	As per Worksheet #30							
No. of Sample Locations	See Worksheet #20							
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Field Duplicate	1 per 20 samples	None		Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤ 5xCRQL	
Temperature Blank	1 per cooler	≤ 6 degrees Celsius		Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL*	
Method Blank	1 per 20 samples or batch	No analyte > CRQL*		Suspend analysis unit source recertified	Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*	
Matrix Spike (Not Required)	1 per 20 samples; if requested	Phenol	26-90 %R	Flag outliers	Laboratory GC/MS Technician	Accuracy	Phenol	26-90 %R

		2-Chlorophenol	25-102 %R				2-Chlorophenol	25-102 %R
		N-Nitroso-di-n-propylamine	41-126 %R				N-Nitroso-di-n-propylamine	41-126 %R
		4-Chloro-3-methylphenol	26-103 %R				4-Chloro-3-methylphenol	26-103 %R
		Acenaphthene	31-137 %R				Acenaphthene	31-137 %R
		4-Nitrophenol	11-114 %R				4-Nitrophenol	11-114 %R
		2,4-Dinitrotoluene	28-89 %R				2,4-Dinitrotoluene	28-89 %R
		Pentachlorophenol	17-109 %R				Pentachlorophenol	17-109 %R
		Pyrene	35-142 %R				Pyrene	35-142 %R

*with the exception of bis (2-Ethylhexyl) phthalate which can be up to 5 times the CRQL. (EPA CLP National Functional Guidelines, Final, July 2007)

QAPP Worksheet #28c
QC Samples Table

QC Sample:	Frequenc y/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
TCL SVOCs – Soil Continued								
Matrix Spike Duplicate (Not Required)	1 per 20 samples; if requested	Phenol	0-35 %RPD	Flag outliers	Laboratory GC/MS Technician	Precision	Phenol	0-35 %RPD
		2-Chlorophenol	0-50 %RPD				2-Chlorophenol	0-50 %RPD
		N-Nitroso-di-n- propylamine	0-38 %RPD				N-Nitroso-di-n- propylamine	0-38 %RPD
		4-Chloro-3- methylphenol	0-33 %RPD				4-Chloro-3- methylphenol	0-33 %RPD
		Acenaphthene	0-19 %RPD				Acenaphthene	0-19 %RPD
		4-Nitrophenol	0-50 %RPD				4-Nitrophenol	0-50 %RPD
		2,4-Dinitrotoluene	0-47 %RPD				2,4-Dinitrotoluene	0-47 %RPD
		Pentachlorophenol	0-47 %RPD				Pentachlorophenol	0-47 %RPD
		Pyrene	0-36 %RPD				Pyrene	0-36 %RPD
Deuterated Monitoring Compounds	all samples	Phenol-d5	17-103 %R	Check calculations and instruments, reanalyze affected samples; up to 4 DMCs may fail to meet recovery limits (Section 11.3.4, Page D48/SVOC of SOM01.2)	Laboratory GC/MS Technician	Accuracy	Phenol-d5	17-103 %R
		Bis(2- chloroethyl)ether-d8	12-98 %R				Bis(2-chloroethyl)ether- d8	12-98 %R
		2-Chlorophenol-d4	13-101 %R				2-Chlorophenol-d4	13-101 %R
		4-Methylphenol-d8	8-100 %R				4-Methylphenol-d8	8-100 %R
		Nitrobenzene-d5	16-103 %R				Nitrobenzene-d5	16-103 %R
		2-Nitrophenol-d4	16-104 %R				2-Nitrophenol-d4	16-104 %R
		2,4-Dichlorophenol- d3	23-104 %R				2,4-Dichlorophenol-d3	23-104 %R
		4-Chloroaniline-d4	1-145 %R				4-Chloroaniline-d4	1-145 %R

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
		Dimethylphthalate-d6	43-111 %R				Dimethylphthalate-d6	43-111 %R
		Acenaphthylene-d8	20-97 %R				Acenaphthylene-d8	20-97 %R
		4-Nitrophenol-d4	16-166 %R				4-Nitrophenol-d4	16-166 %R
		Fluorene-d10	40-108 %R				Fluorene-d10	40-108 %R
		4,6-Dinitro-2-methylphenol-d2	1-121 %R				4,6-Dinitro-2-methylphenol-d2	1-121 %R
		Anthracene-d10	22-98 %R				Anthracene-d10	22-98 %R
		Pyrene-d10	51-120 %R				Pyrene-d10	51-120 %R
		Benzo(a)pyrene-d12	43-111 %R				Benzo(a)pyrene-d12	43-111 %R
Internal Standards	all samples	50-200% of area, \pm 30 second retention time shift		Check calculations and instruments, reanalyze affected samples	Laboratory GC/MS Technician	Accuracy	50-200% of area, \pm 30 second retention time shift	

QAPP Worksheet #28d
QC Samples Table

Matrix		Soil						
Analytical Group		TCL Pesticides including parathion						
Concentration Level		Low (µg/kg)						
Sampling SOP(s)		See Worksheet #21						
Analytical Method/SOP Reference		SOM01.2 Modified						
Sampler's Name		TBD						
Field Sampling Organization		RA Subcontractor						
Analytical Organization		As per Worksheet #30						
No. of Sample Locations		See Worksheet #20						
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Field Duplicate	1 per 20 samples	None		Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤ 5xCRQL	
Temperature Blank	1 per cooler	≤ 6 degrees Celsius		Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL	
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL	
Matrix Spike	1 per 20 samples	gamma-BHC (Lindane)	46-127 %R	Flag outliers	Laboratory GC/ECD Technician	Accuracy	gamma-BHC (Lindane)	46-127 %R
		Heptachlor	35-130 %R				Heptachlor	35-130 %R

		Aldrin	34-132 %R				Aldrin	34-132 %R
		Dieldrin	31-134 %R				Dieldrin	31-134 %R
		Endrin	42-139 %R				Endrin	42-139 %R
		4,4-DDT	23-134 %R				4,4-DDT	23-134 %R
Matrix Spike Duplicate	1 per 20 samples	gamma- BHC	0-50 %RPD	Flag outliers	Laboratory GC/ECD Technician	Precision	gamma- BHC	0-50 %RPD
		Heptachlor	0-31 %RPD				Heptachlor	0-31 %RPD
		Aldrin	0-43 %RPD				Aldrin	0-43 %RPD
		Dieldrin	0-38 %RPD				Dieldrin	0-38 %RPD
		Endrin	0-45 %RPD				Endrin	0-45 %RPD
		4,4-DDT	0-50 %RPD				4,4-DDT	0-50 %RPD

QAPP Worksheet #28d
QC Samples Table

Matrix	Soil	
Analytical Group	TCL Pesticides [cont'd]	
Concentration Level	Low (µg/kg)	
Sampling SOP(s)	See Worksheet #21	
Analytical Method/SOP Reference	SOM01.2	
Sampler's Name	TBD	
Field Sampling Organization	RA Subcontractor	
Analytical Organization	As per Worksheet #30	
No. of Sample Locations	See Worksheet #20	

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Laboratory Control Sample	all samples	gamma-BHC	50-120 %R	Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	gamma-BHC	50-120 %R
		Heptachlor epoxide	50-150 %R				Heptachlor epoxide	50-150 %R
		Dieldrin	30-130 %R				Dieldrin	30-130 %R
		4,4'-DDE	50-150 %R				4,4'-DDE	50-150 %R
		Endrin	50-120 %R				Endrin	50-120 %R
		Endosulfan sulfate	50-120 %R				Endosulfan sulfate	50-120 %R
		gamma-Chlordane	30-130 %R				gamma-Chlordane	30-130 %R
Surrogate	all samples	30-150 %R		Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	30-150 %R	

*Parathion's MPC will be defined by EPA.

QAPP Worksheet #28e
QC Samples Table

Matrix		Soil						
Analytical Group		TCL PCBs						
Concentration Level		Low (µg/kg)						
Sampling SOP(s)		See Worksheet #21						
Analytical Method/SOP Reference		SOM01.2						
Sampler's Name		TBD						
Field Sampling Organization		RA Subcontractor						
Analytical Organization		As per Worksheet #30						
No. of Sample Locations		See Worksheet #20						
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Field Duplicate	1 per 20 samples	None		Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤5xCRQL	
Temperature Blank	1 per cooler	≤ 6 degrees Celsius		Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL	
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL	
Matrix Spike	1 per 20 samples	Aroclor-1016	29-135 %R	Flag outliers	Laboratory GC/ECD Technician	Accuracy	Aroclor-1016	29-135 %R
		Aroclor-1260	29-135 %R				Aroclor-1260	29-135 %R

Matrix Spike Duplicate	1 per 20 samples	Aroclor-1016	0-15 %RPD	Flag outliers	Laboratory GC/ECD Technician	Precision	Aroclor-1016	0-15 %RPD
		Aroclor-1260	0-20 %RPD				Aroclor-1260	0-20 %RPD
Laboratory Control Sample	all samples	Aroclor-1016	50-150 %R	Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	Aroclor-1016	50-150 %R
		Aroclor-1260	50-150 %R				Aroclor-1260	50-150 %R
Surrogate	all samples	30-150%R		Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	30-150%R	

QAPP Worksheet #28f
QC Samples Table

Matrix	Soil					
Analytical Group	TAL – Metals					
Concentration Level	Low (µg/kg)					
Sampling SOP(s)	See Worksheet #21					
Analytical Method/SOP Reference	ISM01.2					
Sampler's Name	TBD					
Field Sampling Organization	RA Subcontractor					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See Worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No constituent > CRQL
Preparation Blank	1 per 20 samples	No constituent > CRQL	Suspend analysis until source rectified; re-digest and reanalyze affected samples	Laboratory ICP-AES/ICP-MS Technician	Accuracy	No constituent > CRQL
Matrix Spike	1 per 20 samples	75-125%R*	Flag outliers		Accuracy	75-125%R*
Laboratory Duplicate	1 per 20 samples	± 35% RPD**	Flag outliers		Precision	± 35% RPD**

Post-Digestion Spike	after any analyte (except Ag and Hg) fails spike %R	75-125%R	Flag outliers		Accuracy	75-125%R
Interference Check Sample [ICP Analysis Only]	beginning, end and periodically during run (2 times every 8 hours)	Within ± 2 times CRQL of true value or $\pm 20\%$ of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples		Sensitivity	Within ± 2 times CRQL of true value or $\pm 20\%$ of true value, whichever is greater
Laboratory Control Sample	1 per 20 samples	Control limits established by EPA*	Suspend analysis rectify source; re-digest and reanalyze affected samples		Accuracy	Control limits established by EPA* or 70-130% recovery

*except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken

**Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

**except when the sample and/or duplicate concentration is less than 5 times the CRQL.

* If the EPA LCS is unavailable, other EPA QC samples or other certified materials may be used. In such cases, control limits for the LCS must be documented and provided.

QAPP Worksheet #28g
QC Samples Table

Matrix	Soil					
Analytical Group	TAL –Total Mercury					
Concentration Level	Low (µg/kg)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	SOM01.2 – Cold Vapor Atomic Absorption (CVAA)					
Sampler's Name	TBD					
Field Sampling Organization	RA Subcontractor					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤ 5xCRQL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Preparation Blank (PB)	1 per 20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	Laboratory Technician	Accuracy	No analyte > CRQL
Laboratory Duplicate	1 per 20 samples	± 35% RPD	Flag outliers	Laboratory Technician	Precision	± 35% RPD
Spike Sample	1 per 20 samples	75 – 125 %R	Flag outliers	Laboratory Technician	Accuracy	75 – 125 %R

Laboratory Control Sample	1 20 samples	Control limits established by EPA*	Flag outliers	Laboratory Technician	Accuracy	Control limits established by EPA*
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* If the EPA LCS is unavailable, other EPA QC samples or other certified materials may be used. In such cases, control limits for the LCS must be documented and provided.

QAPP Worksheet #28h
QC Samples Table

Matrix	Soil					
Analytical Group	Herbicide (2,4,5-T, silvex, and 2,4-D)					
Concentration Level	Low (µg/kg)					
Sampling SOP(s)	See Worksheet #21					
Analytical Method/SOP Reference	SOM01.2					
Sampler's Name	TBD					
Field Sampling Organization	RA Subcontractor					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See Worksheet #20					
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤ 5xCRQL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL	Suspend analysis unit source recertified	Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL
Matrix Spike	1 per 20 samples	65 – 135 % R	Flag outliers	Laboratory GC/ECD Technician	Accuracy	65 – 135 % R
Matrix Spike Duplicate	1 per 20 samples	65 – 135 % R	Flag outliers	Laboratory GC/ECD Technician	Precision	65 – 135 % R

Laboratory Control Sample	all samples	80 – 120 % R	Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	80 – 120 % R
Surrogate	all samples	30-150%R	Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	30-150%R

QAPP Worksheet #28i
QC Samples Table

Matrix	Soil					
Analytical Group	Grain Size					
Concentration Level	Low/Medium (percent particle sizes)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	ASTM D421-85 and ASTM D422-63					
Sampler's Name	TBD					
Field Sampling Organization	CDM					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (Project-specific)
Per ASTM Method	Per ASTM Method	Per ASTM Method	Per ASTM Method	laboratory analyst	Per ASTM Method	Per ASTM Method

Notes:

1. The laboratory will be required to ensure that QC is performed in accordance with the ASTM method.
2. The data obtained will be compared to publish data and to other data obtained from the site (i.e., lithologic logs) by the geotechnical engineer/hydrogeologist and any Abnormalities will be flagged.
3. The data will not be validated.

QAPP Worksheet #28j
QC Samples Table

Matrix	Groundwater					
Analytical Group	TCL VOCs					
Concentration Level	Trace (µg/L)					
Sampling SOP(s)	See Worksheet #21					
Analytical Method/SOP Reference	SOM01.2					
Sampler's Name	TBD					
Field Sampling Organization	RA Subcontractor					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See Worksheet #20					
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	25 % RPD ABS ≤ 5xCRQL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Trip Blank	1 per cooler	≤ CRQL	Verify results; re-analyze. Flag outliers	Laboratory analyst	Accuracy / Contamination	No analyte > CRQL
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Method Blank	1 every 12 hours	No analyte > CRQL*	Suspend analysis unit source recertified	Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*

Matrix Spike (Not Required)	1 per 20 samples; if requested	1,1- Dichloroethene	61-145 %R	Flag outliers		Accuracy	1,1- Dichloroethene	61-145 %R
		Benzene	76-127 %R				Benzene	76-127 %R
		Trichloroethene	71-120 %R				Trichloroethene	71-120 %R
		Toluene	76-125 %R				Toluene	76-125 %R
		Chlorobenzene	75-130 %R				Chlorobenzene	75-130 %R
Matrix Spike Duplicate (Not Required)	1 per 20 samples; if requested	1,1- Dichloroethene	0-14 %RPD	Flag outliers		Precision	1,1- Dichloroethene	0-14 %RPD
		Benzene	0-11 %RPD				Benzene	0-11 %RPD
		Trichloroethene	0-14 %RPD				Trichloroethene	0-14 %RPD
		Toluene	0-13 %RPD				Toluene	0-13 %RPD
		Chlorobenzene	0-13 %RPD				Chlorobenzene	0-13 %RPD

Deuterated Monitoring Compounds	all samples	Vinyl chloride-d3	65-131 %R	Check calculations and instruments, reanalyze affected samples		Accuracy	Vinyl chloride-d3	65-131 %R
		Chloroethane-d5	71-131 %R				Chloroethane-d5	71-131 %R

*with the exception of methylene chloride, 2-butanone and acetone which can be up to 2 times the CRQL, or in some situations may require these compounds be up to 4 times the CRQL.

QAPP Worksheet #28k
QC Samples Table

QC Sample:	Frequen cy/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicat or (DQI)	Measurement Performance Criteria	
TCL VOCs Continued								
Deuterated Monitoring Compound s [cont'd]	all samples	1,1-Dichloroethene-d2	55-104 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet recovery limits	Laboratory GC/MS Technician	Accura cy	1,1-Dichloroethene-d2	55-104 %R
		2-Butanone-d5	49-155 %R				2-Butanone-d5	49-155 %R
		Chloroform-d	78-121 %R				Chloroform-d	78-121 %R
		1,2-Dichloroethane-d4	78-129 %R				1,2-Dichloroethane-d4	78-129 %R
		Benzene-d6	77-124 %R				Benzene-d6	77-124 %R
		1,2-Dichloropropane-d6	79-124 %R				1,2-Dichloropropane-d6	79-124 %R
		Toluene-d8	77-121 %R				Toluene-d8	77-121 %R
		trans-1,3-Dichloropropene-d4	73-121 %R				trans-1,3-Dichloropropene-d4	73-121 %R
		2-Hexanone-d5	28-135 %R				2-Hexanone-d5	28-135 %R
		1,4-Dioxane-d8	50-150 %R				1,4-Dioxane-d8	50-150 %R
		1,1,2,2-Tetrachloroethane-d2	73-125 %R				1,1,2,2-Tetrachloroethane-d2	73-125 %R
		1,2-Dichlorobenzene-d4	80-131 %R				1,2-Dichlorobenzene-d4	80-131 %R

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator or (DQI)	Measurement Performance Criteria
Internal Standards	all samples	60-140%	Check calculations and instruments, reanalyze affected samples		Accuracy	$\pm 40\%$ of response area, ± 20 sec retention time shift

QAPP Worksheet #28I
QC Samples Table

Matrix	Groundwater					
Analytical Group	TAL inorganic Metals					
Concentration Level	Low (µg/L)					
Sampling SOP(s)	See Worksheet #21					
Analytical Method/SOP Reference	ISM01.2					
Sampler's Name	TBD					
Field Sampling Organization	RA Subcontractor					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See Worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	≤20% RPD ABS ≤ 5xCRQL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No constituent > CRQL
Preparation Blank	1 per 20 samples	No constituent > CRQL	Suspend analysis rectify source; redigest and reanalyze affected samples	Laboratory ICP Technician	Accuracy	No constituent > CRQL
Spike	1 per 20 samples	75-125%R*	Flag outliers	Laboratory ICP Technician	Accuracy	75-125%R*
Laboratory Duplicate	1 per 20 samples	± 20% RPD**	Flag outliers	Laboratory ICP Technician	Precision	± 20% RPD**

Post-Digestion Spike	after any analyte (except Ag and Hg) fails spike %R	75-125%R	Flag outliers	Laboratory ICP Technician	Accuracy	75-125%R
Interference Check Sample [ICP Analysis Only]	beginning, end and periodically (not less than 1 per 20 samples)	$\pm 2 \times$ CRQL of true value or $\pm 20\%$ of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples	Laboratory ICP Technician	Sensitivity	± 2 times CRQL of true value or $\pm 20\%$ of true value, whichever is greater
Laboratory Control Sample	1 per 20 samples	80-120%R (except Ag and Sb)	Suspend analysis until source rectified; redigest and reanalyze affected samples	Laboratory ICP Technician	Accuracy	80-120%R (except Ag and Sb)

*except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken

**Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

**except when the sample and/or duplicate concentration is less than 5 times the CRQL, then \pm CRQL.

QAPP Worksheet #28m
QC Samples Table

Matrix	Groundwater
Analytical Group	TAL – Total Mercury
Concentration Level	Low (µg/L)
Sampling SOP(s)	See worksheet #21
Analytical Method/SOP Reference	ISM01.2 – Cold Vapor Atomic Absorption (CVAA)
Sampler's Name	TBD
Field Sampling Organization	RA Subcontractor
Analytical Organization	As per Worksheet #30
No. of Sample Locations	See worksheet #20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	≤20% RPD
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Preparation Blank (PB)	1 per 20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	Laboratory Technician	Accuracy	No analyte > CRQL
Laboratory Duplicate	1 per 20 samples	± 20% RPD*	Flag outliers	Laboratory Technician	Precision	≤ 20% RPD
Spike Sample	1 per 20 samples	75 – 125 %R	Flag outliers	Laboratory Technician	Accuracy	75 – 125 %R

Laboratory Control Sample	1 per 20 samples	80-120%R	Suspend analysis until source rectified; redigest and reanalyze affected samples	Laboratory Technician	Accuracy	80-120%R
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*Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

QAPP Worksheet #28n
QC Samples Table

Matrix	Groundwater
Analytical Group	TAL – Total Cyanide
Concentration Level	Low (µg/L)
Sampling SOP(s)	See worksheet #21
Analytical Method/SOP Reference	ISM01.2
Sampler's Name	TBD
Field Sampling Organization	RA Subcontractor
Analytical Organization	As per Worksheet #30
No. of Sample Locations	See worksheet #20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	≤20% RPD
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Preparation Blank (PB)	1 per 20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	Laboratory Technician	Accuracy	No analyte > CRQL
Laboratory Duplicate	1 per 20 samples	± 20% RPD*	Flag outliers	Laboratory Technician	Precision	≤ 20% RPD
Spike Sample	1 per 20 samples	75 – 125 %R	Flag outliers	Laboratory Technician	Accuracy	75 – 125 %R

Laboratory Control Sample	1 per 20 samples	85-115%R	Suspend analysis until source rectified; redigest and reanalyze affected samples	Laboratory Technician	Accuracy	85-115%R
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*Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

QAPP Worksheet #28o
QC Samples Table

Matrix	Groundwater					
Analytical Group	Nitrate/Nitrite					
Concentration Level	Low (mg/L)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	353.2					
Sampler's Name	TBD					
Field Sampling Organization	RA Subcontractor					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Blank (FB)	1 per decontamination event not to exceed 1 per day	None	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy/Sensitivity	No analyte > QL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Duplicate	1 per 20 samples	None	Data assessor to inform RA Subcontractor Personnel if MPC is exceeded; flag duplicate results	RA Subcontractor Personnel	Precision	≤ 25% RPD ABS ≤ 5xCRQL
Preparation Blank (PB)	1 per 20 samples	None	Suspend analysis; check; redigest and reanalyze	Laboratory Analyst	Accuracy/Sensitivity	No analyte > QL

Laboratory Duplicate	1 per 20 samples	None	Flag outliers	Laboratory Analyst	Precision	≤ 20% RPD
Spike Samples	1 per 20 samples	90-110%	Flag outliers	Laboratory Analyst	Accuracy	75-125%R
Laboratory Control Sample	After calibration, every 20 samples and at end of day	90-110%	Identify source of problem, correct and reanalyze	Laboratory Analyst	Accuracy	90-110%R

Control limits for the LCS must be documented and provided.

QAPP Worksheet #28p
QC Samples Table

Matrix	Groundwater
Analytical Group	Oil and Grease
Concentration Level	Low (mg/L)
Sampling SOP(s)	See worksheet #21
Analytical Method/SOP Reference	1664a
Sampler's Name	TBD
Field Sampling Organization	RA Subcontractor
Analytical Organization	Field Analysis
No. of Sample Locations	See worksheet #20

Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Blank	1 per decontamination event not to exceed 1 per day	No analyte > QL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy/Sensitivity	No analyte > QL
Field Duplicate	1 per 20 samples	None	Reanalyze. Re-perform calibration check if still outlying.	Field analyst	Precision	≤ 20% RPD
Preparation Blank	Daily or 1 per 20 samples	No analyte > QL	Suspend analysis; re-prep and reanalyze	Field analyst	Accuracy/Sensitivity	No analyte > QL

Matrix Spike	1 per 20 samples	78-114%	Identify source of problem, correct and reanalyze	Laboratory Analyst	Accuracy	78-114%R
Laboratory Duplicate	Daily or 1 per 20 samples	18% RPD	Reanalyze. Re-perform calibration check if still outlying.	Laboratory Analyst	Precision	≤ 20% RPD
Initial Precision and Recovery	Once at method startup and anytime method is changed	83-101% RPD≤11	Reanalyze. Re-perform calibration check if still outlying.	Laboratory Analyst	Accuracy and Precision	83-101% RPD≤11
LCS (ongoing precision and recovery)	Daily or 1 per 20 samples	78-114%	Identify source of problem, correct and reanalyze	Laboratory Analyst	Accuracy	78-114%R

Control limits for the LCS based on SW846 Method 1664a Table 1 criteria..

QAPP Worksheet #28q
QC Samples Table

Matrix	Groundwater					
Analytical Group	TSD and TSS					
Concentration Level	Low (mg/L)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	SM 2540C and SM 2540D					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per worksheet 30					
No. of Sample Locations	See worksheet #20					
Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Blank	1 per decontamination event not to exceed 1 per day	No analyte > QL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy/Sensitivity	No analyte > QL
Field Duplicate	1 per 20 samples	None	Reanalyze. Re-perform calibration check if still outlying.	Field analyst	Precision	≤ 25% RPD
Preparation Blank	Daily or 1 per 20 samples	No analyte > QL	Suspend analysis; re-prep and reanalyze	Laboratory Analyst	Accuracy/Sensitivity	No analyte > QL
LCS	Daily or 1 per 20 samples	85-115%	Identify source of problem, correct and reanalyze	Laboratory Analyst	Accuracy	85-115%R

Laboratory Duplicate	1 per 20 samples	±20% RPD	Reanalyze. Re-perform calibration check if still outlying.	Laboratory Analyst	Precision	± 20% RPD
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Control limits for the LCS based on method criteria.

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Documents Prepared/Submitted by Arrowhead				
COC Records	Photographs	Subcontract	Validated Data Reports	Project Contract, Drawings and Specifications
Airbills	Equipment Calibration and Maintenance Log	Lower Tier Subcontracts	Data Validation SOPs	Project Work Plan
Sample Tracking Log/Sheets	Field Data Collection Logs	Purchase Orders	Data Package Completeness Checklist (Data Validator)	UFP-QAPP
Field Logbooks	Log of Water Quality Parameters	Certified Payroll	Corrective Action Reports	Contractor Quality Control Plan
Daily Quality Control Summary Reports	PID Logs	Project Correspondence	Field Sampling Audit Plans, Reports and Checklists	Environmental Protection Plan
	Meteorological Data	Corrective Action Forms	-	Health and Safety Plan
	Sample Disposal and Waste Manifests	Project Correspondence	-	Survey Records
-		-	-	O&M monthly reports
-		-	-	Personnel Certifications
-		-	-	Electronic Data Deliverables
-		-	-	Data Qualification Assessment
-		-	-	Water Level Measurement Record

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Documents Prepared/Submitted by the Respective Analytical Laboratory				
-	-	Data Packages (Case Narratives, Sample Results, QC Summaries and Raw Data (detailed in laboratory SOPs).	Analytical sample results	Electronic Data Deliverables
-	-	Standards Tracking Logs	Test America certifications	-
-	-	Sample Preparation Logs	Test America QA Plan (on file with EPA, CDM and RA Subcontractor)	-
-	-	Run Logs	Corrective Action Reports	-
-	-	Corrective Action Reports	-	-
-	-	Corrective Action Forms	-	-
-	-	-	-	-

QAPP Worksheet #30
Project Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
Soil Sampling During Earthwork Construction Activities							
Imported Granular Material Sampling*							
Soil	TCL VOCs	Low	See Worksheet #18	SOM01.2	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Sara Goff	TBD
	TAL Metals (including mercury)	Low	See Worksheet #18	ISM01.2	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Sara Goff	TBD
	TCL SVOCs including aniline	Low	See Worksheet #18	SOM01.2	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Sara Goff	TBD
	PCBs	Low	See Worksheet #18	SOM01.2	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Sara Goff	TBD

QAPP Worksheet #30
Project Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
	Pesticides including parathion	Low	See Worksheet #18	SOM01.2	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Sara Goff	TBD
Soil	Herbicide (2,4,5-T, silvex and 2,4-D)	Low	See Worksheet #18	SW846 8151	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Sara Goff	TBD
Excess/Unsuitable Material Sampling							
Soil	TBD by requirements of disposal facility	Standard	See Worksheet #18	TBD	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Sara Goff	TBD
Geotechnical Testing							
Soil	Standard Proctor	NA	See Worksheet #18	ASTM D698	7-Day	TBD	TBD

QAPP Worksheet #30
Project Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
Soil	Grain Size	NA	See Worksheet #18	ASTM D421-85 & D422-63	7-Day	TBD	TBD

**QAPP Worksheet #30
Project Analytical Services Table**

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
Groundwater Treatment System							
Initial Testing Program							
Groundwater – Influent Sampling	TCL VOCs	Trace	See Worksheet #18	SOM01.2	7-Day	Test America	TBD
	Total Iron	Low (ICP-MS/AES)	See Worksheet #18	ISM01.2	7-Day	Test America	TBD
Groundwater – Process Sampling after EQ Tank	TCL VOCs and Total Iron	Trace	See Worksheet #18	SOM01.2 ISM01.2	7-Day	Test America	TBD
Groundwater – Compliance Sampling after Static Mixer)	TAL Metals, Mercury, and Cyanide	Low	See Worksheet #18	ISM01.2	7-Day	Test America	TBD
	TCL VOCs	Trace	See Worksheet #18	SOM01.2	7-Day	Test America	TBD
	Oil and Grease	Low	See Worksheet #18	1664a	7-Day	Test America	TBD
	Nitrate/Nitrite	Low	See Worksheet #18	353.2	7-Day	Test America	TBD

QAPP Worksheet #30
Project Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
	TSS, TDS	Low	See Worksheet #18	SM 2540C, SM 2540D	7-Day	Test America	TBD
O&M							
Groundwater – Influent Sampling	TCL VOCs	Trace	See Worksheet #18	SOM01.2	14-Day	Test America	TBD
	Total Iron	Low	See Worksheet #18	ISM01.2	14-Day	Test America	TBD
Groundwater – Compliance Sampling after Static Mixer	TAL Metals, Mercury, and Cyanide	Low	See Worksheet #18	ISM01.2	14-Day	Test America	TBD
	TCL VOCs	Trace	See Worksheet #18	SOM01.2	14-Day	Test America	TBD
	Oil and Grease	Low	See Worksheet #18		14-Day	Test America	TBD
	Nitrate/Nitrite	Low	See Worksheet #18		14-Day	Test America	TBD
	TSS, TDS	Low	See Worksheet #18	SM 2540C, SM 2540D	14-Day	Test America	TBD
Optional Scope <i>TBD based on soil and groundwater screening results from the pre-remedial action soil borings. If option is implemented then the sampling and analysis will be similar to the base scope for baseline, pre-final and final sampling events.</i>							

1. Please note that the required quantification limits and CLP method options are detailed on worksheet 15

**QAPP Worksheet #31
Planned Project Assessments Table**

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Sample collection and documentation	Once if warranted	Internal	Arrowhead	TBD	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Health and Safety	Once if warranted	Internal	Arrowhead	Scott Siegwald (CHSO)	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Field Audit	Once if warranted	Internal	Arrowhead	Approved field auditor	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Field Audit	Once, at a minimum	Internal	Arrowhead	Approved field auditor	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Office Audit	Once if warranted	Internal	Arrowhead	Approved Office Auditor	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Laboratory Audit	Once if warranted	Internal	Arrowhead	Approved laboratory auditor	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
QAPP	Annually	Internal	Arrowhead	QA Coordinator	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Data Review	As required	Internal	Arrowhead	Arrowhead Staff	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)

**QAPP Worksheet #32
Assessment Findings and Corrective Action Responses**

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Sample collection and documentation	Memorandum	Doug Ronk (PM)	Day of audit	Verbal briefing; Corrective Action Notice if immediate corrective action not possible or critical violations noted	Greg Wallace (CQO)	Immediate CA required where possible; otherwise as specified on the CA Notice, typically 15 to 30 days from date of CA Notice
Health and Safety	Audit checklist	Doug Ronk (PM)	Notify by phone immediately Report 1 week after audit	Memorandum and checklist	Greg Wallace (CQO) Scott Siegwald (CHSO)	
Field Audit	Field Audit Report (Subcontractor)	Doug Ronk (PM)	Provide summary of findings to field team on day of audit; Draft Report due within 10-15 days	Corrective Action Plan provided to CDM	Greg Wallace (CQO)	
Field Audit	Field Audit Report	Doug Ronk (PM)	Provide summary of findings to field team on day of audit; Draft Report due within 10-15 days	Corrective Action Plan	Greg Wallace (CQO)	

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Office Audit	Office Audit Report	Doug Ronk (PM)	Provide summary of findings to SM on day of audit; Draft Report due within 10-15 days	Memorandum	Greg Wallace (CQO)	
QAPP	Memorandum	Doug Ronk (PM)	Draft Report due 30 days	Memorandum and/or FCRs	Greg Wallace (CQO)	
Data Review	Memorandum	Doug Ronk (PM)	Notify by phone immediately	Memorandum	Greg Wallace (CQO)	

QAPP Worksheet #33
QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Change Requests	As needed	Promptly – prior to initiation of change or as requested by EPA	Doug Ronk (PM)	QAPP recipients
QAPP Addendums	As needed	As per client request	Doug Ronk (PM)	QAPP recipients
Field Audit Report	Once (if audit is conducted)	15 days (draft) and 30 days (final) after audit	Doug Ronk (PM)	CDM Greg Wallace (QCO)
Office Audit Report	Once (if audit is conducted)	15 days (draft) and 30 days (final) after audit	Doug Ronk (PM)	
Corrective Action Reports	As required on CA request	As per corrective action request	Doug Ronk (PM)	
Daily Quality Control Summary Reports (DQCSR)	Daily during construction	Next Day	Joe Cotter (SM)	CDM Doug Ronk (PM)
Data Usability Assessments	With each Measurement Report (unless data previously reported)	With each Measurement Report	Data Validator	CDM Doug Ronk (PM)
Monthly O&M Reports	Monthly	Monthly	Doug Ronk (PM)	CDM

QAPP Worksheet #34
Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of custody	Form will be internally reviewed upon completion and verified against field logs, laboratory report and QAPP. Review will be conducted with completion of each measurement report.	Internal	Data Validator
Daily QC/Summary Report	Daily Quality Control Summary Report will be verified with field log books to ensure correct reporting of information. Review will be conducted with completion of each report.	Internal	Doug Ronk (PM)
		External	CDM
Field Logbooks	Field logbooks will be reviewed for accuracy and completeness and placed in project file.	Internal	Joe Cotter (SM)
Laboratory Logbooks	Laboratory logbooks will be reviewed for accuracy and completeness and placed in project file.	External	Subcontract Laboratory, Test America
Field and Laboratory data and QC Report	Data validation reports, QAPP, FCRs and outputs of the EQuIS database will be used to prepare the project data quality and usability assessment report. The data will be evaluated against project DQOs and measurement performance criteria, such as completeness.	Both	Data Validator
Field Sampling Procedures	Evaluate whether field sampling procedures were followed with respect to equipment and proper sampling support using audit and sampling reports, field change request forms and field logbooks.	External	CDM
		Internal	Tom Gleave (SQCO)
Laboratory Data	All laboratory data will be verified by the laboratory performing the analysis for completeness and technical accuracy prior to submittal to EPA. Subsequently, EPA or its contractor will evaluate the data packages for completeness and compliance. Table 9 of the IDQTF UFP-QAPP shows items for compliance review.	External	CDM
Electronic Data Deliverables (EDDs)	Determine whether required fields and format were provided.	Internal	Doug Ronk (PM)
QAPP	All planning documents will be available to report writers and reviewers to allow reconciliation with planned activities and objectives.	Internal /External	All data users

QAPP Worksheet #35
Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	Methods	Records support implementation of the SOP - sampling and analysis	Chemical Quality Control Officer, Scott Siegwald.
IIa	Chain of Custody	Examine traceability of data from sample collection to generation of project reported data. Provides sampling dates and time; verification of sample ID; and QC sample information.	
IIb	Data Narrative	Determine deviations from methods and contract and the impact on data use.	
IIb	Audit Report	Reports used to validate compliance of field sampling, handling and analysis activities with the QAPP.	
IIb	Project Quantification Limit	PQL achieved as outlined in the QAPP and that the laboratory successfully analyzed a standard at the QL.	
IIb	Field data and Field QC	Field logbooks and field data results will be compared against the QAPP measurement performance criteria and data validation SOP requirements.	
IIb	Data Package	Used to perform data validation on 100% of all CLP data. All data from Test America will be validated by a third party chemist Ensure that all analytical procedures were followed. Corrective actions will be taken and documented when applicable per specific methods. Deviations will be documented. Data will be qualified in accordance with specific methods.	

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Date Validator (Title, Organization)
IIa / IIb	Soil	TCL VOCs	Low	SOP HW-33, rev 1	Subcontractor's validator/ designee
IIa / IIb	Soil	TCL SVOCs	Low	SOP HW-35, rev 1	Subcontractor's validator/ designee
IIa / IIb	Soil	TAL Metals including mercury	Low	SOP HW-2, rev 13	Subcontractor's validator/ designee
IIa /IIb	Soil	TCL Pesticides	Low	SOP HW-36, rev 1	Subcontractor's validator/ designee
IIa / IIb	Soil	TCL PCBs	Low	SOP HW-37, rev 1	Subcontractor's validator/ designee
IIa / IIb	Soil	Herbicides	Low	SOP HW-17, rev 2	Subcontractor's validator/ designee
IIa / IIb	Groundwater	TCL VOCs	Trace	SOP HW-34, rev 1	Subcontractor's validator/ designee
IIa / IIb	Groundwater	TAL Metals including mercury and cyanide	Low	SOP HW-2, rev 13	Subcontractor's validator/ designee
IIa / IIb	Groundwater	TDS, TSS	Low	USEPA National Functional Guidelines (2004), EPA method SM 2540C and SM 2540D (as applicable)-	Subcontractor's validator/ designee
IIa / IIb	Groundwater	Oil and Grease	Low	USEPA National Functional Guidelines (2004), EPA method 1664	Subcontractor's validator/ designee
IIa / IIb	Groundwater	Nitrate/Nitrite	Low	USEPA National Functional Guidelines (2004), EPA Method 353.2	Subcontractor's validator/ designee
IIa /IIb	Air	VOCs	Low	SOP HW-31 Revision 4	Subcontractor's validator/ designee

Note: Ferrous iron and grain size analyses will not be validated.

**QAPP Worksheet #37
Usability Assessment**

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

The PM (Doug Ronk) will be responsible for information in the Usability Assessment. He will be responsible for assigning the work to the Chemical Quality Control Officer who will be preparing the Data Usability Assessment. Note that the Data Usability Assessment will be conducted on validated data. The results of the Data Usability Assessment will be presented with each measurement report. After the Data Usability Assessment has been performed, data deemed appropriate for use will then be used with each measurement report. The following items will be assessed and conclusions drawn based on their results.

Precision – Results of laboratory duplicates will be assessed during data validation and data will be qualified according to the data validation procedures cited on Worksheet #36. Field duplicates will be assessed by matrix using the RPD or absolute difference for each pair of results reported in accordance with the MPCs on the Worksheets #12 and #28. Absolute difference will be used for low results as described in worksheets 12 and 28. A discussion summarizing the results of laboratory and field precision and any limitations on the use of the data will be described.

Field duplicates - The data assessor will review the data validation report. If the field duplicate comparison is not included, it will be performed by the assessor. The data assessor will review the extent of exceedance of the field duplicate criteria. The sample results will be flagged according to the data validation protocol. Based on this review, the data assessor will determine whether the exceedance is due to inherent soil heterogeneity or the result of sample handling in the field or laboratory. This information will be included in the data assessment report. As an added measure, the field team leader will be asked to inspect the soil coning and quartering procedures and re-train staff if needed.

Accuracy/Bias Contamination – Results for all laboratory blanks will be assessed as part of the data validation. During the data validation process the validator will qualify the data following the procedures described on Worksheet #36. A discussion summarizing the results of laboratory accuracy and bias based on contamination will be presented and any limitations on the use of the data will be described.

Overall Accuracy/Bias – The results of instrument calibration laboratory control samples and matrix spike recoveries will be reviewed and data will be qualified according to the data validation procedures cited on Worksheet #36. A discussion summarizing the results of laboratory accuracy and any limitations on the use of the data will be described.

Sensitivity – Data results will be compared to criteria provided on Worksheet #15. A discussion summarizing any conclusions about sensitivity of the analyses will be presented and any limitations on the use of the data will be described.

QAPP Worksheet #37
Usability Assessment

Representativeness – A review of adherence to the sampling plan, field procedures and of project QA audits will be performed in order to assess the representativeness of the sampling program. Data validation narratives will also be reviewed and any conclusions about the representativeness of the data set will be discussed.

Comparability – The results of this study will be used in conjunction with existing data to make qualitative and quantitative assessments of the data to be used to produce the Site reports.

Reconciliation – The DQIs presented in Worksheet #12 will be examined to determine if the MPC were met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of major impacts observed from data validation, data quality indicators and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. Based on the data, the usability of the data for each analysis will be determined. The combined usability of the data will determine if the DQIs were met and whether project goals were achieved. Conclusions will be drawn and any limitations on the usability of any of the data will be described.

Completeness - The database will be queried to summarize the number of samples in each analytical fraction that are estimated and rejected. This data will be used along with the planned samples indicated in the QAPP to calculate the completeness of the obtained data set. These results will then be compared to the MPC in Worksheets #12 and #28. Completeness evaluation results will be used to evaluate whether data gaps exist and whether critical data points or data results are missing.

The following equations will be used :

1. To calculate field duplicate precision: $RPD = 100 \times 2 |X1 - X2| / (X1 + X2)$ where X1 and X2 are the reported concentrations for each duplicate or replicate
2. To calculate completeness: $\% \text{ Completeness} = V/n \times 100$ where V= number of measurements judged valid; n = total number of measurements made and
 $\% \text{ Completeness} = C/x \times 100$ where C= number of samples collected; x = total number of measurements planned

2. Describe the evaluative procedures used to assess overall measurement error associated with the project:

Arrowhead's data assessor will determine if quality control data is within specifications (MPC) through the data assessment validation process IIb.

**QAPP Worksheet #37
Usability Assessment**

3. Identify the personnel responsible for performing the usability assessment: Chemical Quality Control Officer

4. Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The usability report will include a discussion of the accuracy, precision, representativeness, completeness and comparability of the data set and deviations from planned procedures and analysis and the impact on the project objectives. Tables will be prepared, including: a summary of planned samples, collected samples and parameters analyzed; detections in field and trip blanks; comparison of field duplicates; estimated and rejected data; and a comparison of planned and actual detection limits.

The procedures described above will be used to ensure that the data generated will meet the data quality objectives outlined in the remedial design specifications to ensure the data meets the needs of the RA. The data generated will be used to complete the following steps in preparing the interim RA Report.

- Confirming the achievement of remedial system performance requirements
- Confirming compliance with NYSDEC SPDES and Air Pollution Permit Equivalent
- Assessing groundwater treatment system RA progress and support decisions regarding treatment system operation and optimization
- Identifying data gaps - As soon as data gaps are identified during the RA Arrowhead will discuss them with CDM. To identify data gaps, Arrowhead will evaluate the analytical results by media and determine if results indicate levels or locations of contamination that need to be further investigated. Identifying data gaps shall be reported as soon as possible during the RA so that corrective action could be made.
- Using qualified data - CDM utilizes all data not rejected during validation to determine compliance with the RA objectives.
- Deciding if high results are legitimate or outliers - CDM will assume that all data not rejected during validation will be considered in determining compliance with the RA objectives. CDM will work with EPA if there is a concern about the statistical validity of the sample results. In particular, high "outlier" results that have no surrounding comparable results as confirmation will be discussed with EPA.

Appendix A
New York State Department of Conservation
DER-10/Technical Guidance for Site Investigation and Remediation
Appendix 5 – Allowable Constituent Levels for Imported Fill or Soil

Appendix 5

Allowable Constituent Levels for Imported Fill or Soil

Subdivision 5.4(e)

Source: This table is derived from soil cleanup objective (SCO) tables in 6 NYCRR 375. Table 375-6.8(a) is the source for unrestricted use and Table 375-6.8(b) is the source for restricted use.

Note: For constituents not included in this table, refer to the contaminant for supplemental soil cleanup objectives (SSCOs) in the Commissioner Policy on Soil Cleanup Guidance. If an SSCO is not provided for a constituent, contact the DER PM to determine a site-specific level.

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Metals					
Arsenic	13	16	16	16	13
Barium	350	350	400	400	433
Beryllium	7.2	14	47	47	10
Cadmium	2.5	2.5	4.3	7.5	4
Chromium, Hexavalent ¹	1 ³	19	19	19	1 ³
Chromium, Trivalent ¹	30	36	180	1500	41
Copper	50	270	270	270	50
Cyanide	27	27	27	27	NS
Lead	63	400	400	450	63
Manganese	1600	2000	2000	2000	1600
Mercury (total)	0.18	0.73	0.73	0.73	0.18
Nickel	30	130	130	130	30
Selenium	3.9	4	4	4	3.9
Silver	2	8.3	8.3	8.3	2
Zinc	109	2200	2480	2480	109
PCBs/Pesticides					
2,4,5-TP Acid (Silvex)	3.8	3.8	3.8	3.8	NS
4,4'-DDE	0.0033 ³	1.8	8.9	17	0.0033 ³
4,4'-DDT	0.0033 ³	1.7	7.9	47	0.0033 ³
4,4'-DDD	0.0033 ³	2.6	13	14	0.0033 ³
Aldrin	0.005	0.019	0.097	0.19	0.14
Alpha-BHC	0.02	0.02	0.02	0.02	0.04 ⁴
Beta-BHC	0.036	0.072	0.09	0.09	0.6
Chlordane (alpha)	0.094	0.91	2.9	2.9	1.3
Delta-BHC	0.04	0.25	0.25	0.25	0.04 ⁴
Dibenzofuran	7	14	59	210	NS
Dieldrin	0.005	0.039	0.1	0.1	0.006
Endosulfan I	2.4 ²	4.8	24	102	NS
Endosulfan II	2.4 ²	4.8	24	102	NS
Endosulfan sulfate	2.4 ²	4.8	24	200	NS
Endrin	0.014	0.06	0.06	0.06	0.014
Heptachlor	0.042	0.38	0.38	0.38	0.14
Lindane	0.1	0.1	0.1	0.1	6
Polychlorinated biphenyls	0.1	1	1	1	1

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Semi-volatile Organic Compounds					
Acenaphthene	20	98	98	98	20
Acenaphthylene	100	100	100	107	NS
Anthracene	100	100	100	500	NS
Benzo(a)anthracene	1	1	1	1	NS
Benzo(a)pyrene	1	1	1	1	2.6
Benzo(b)fluoranthene	1	1	1	1.7	NS
Benzo(g,h,i)perylene	100	100	100	500	NS
Benzo(k)fluoranthene	0.8	1	1.7	1.7	NS
Chrysene	1	1	1	1	NS
Dibenz(a,h)anthracene	0.33 ³	0.33 ³	0.33 ³	0.56	NS
Fluoranthene	100	100	100	500	NS
Fluorene	30	100	100	386	30
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.5	5.6	NS
m-Cresol(s)	0.33 ³	0.33 ³	0.33 ³	0.33 ³	NS
Naphthalene	12	12	12	12	NS
o-Cresol(s)	0.33 ³	0.33 ³	0.33 ³	0.33 ³	NS
p-Cresol(s)	0.33	0.33	0.33	0.33	NS
Pentachlorophenol	0.8 ³	0.8 ³	0.8 ³	0.8 ³	0.8 ³
Phenanthrene	100	100	100	500	NS
Phenol	0.33 ³	0.33 ³	0.33 ³	0.33 ³	30
Pyrene	100	100	100	500	NS
Volatile Organic Compounds					
1,1,1-Trichloroethane	0.68	0.68	0.68	0.68	NS
1,1-Dichloroethane	0.27	0.27	0.27	0.27	NS
1,1-Dichloroethene	0.33	0.33	0.33	0.33	NS
1,2-Dichlorobenzene	1.1	1.1	1.1	1.1	NS
1,2-Dichloroethane	0.02	0.02	0.02	0.02	10
1,2-Dichloroethene(cis)	0.25	0.25	0.25	0.25	NS
1,2-Dichloroethene(trans)	0.19	0.19	0.19	0.19	NS
1,3-Dichlorobenzene	2.4	2.4	2.4	2.4	NS
1,4-Dichlorobenzene	1.8	1.8	1.8	1.8	20
1,4-Dioxane	0.1 ³	0.1 ³	0.1 ³	0.1 ³	0.1
Acetone	0.05	0.05	0.05	0.05	2.2
Benzene	0.06	0.06	0.06	0.06	70
Butylbenzene	12	12	12	12	NS
Carbon tetrachloride	0.76	0.76	0.76	0.76	NS
Chlorobenzene	1.1	1.1	1.1	1.1	40
Chloroform	0.37	0.37	0.37	0.37	12
Ethylbenzene	1	1	1	1	NS
Hexachlorobenzene	0.33 ³	0.33 ³	1.2	3.2	NS
Methyl ethyl ketone	0.12	0.12	0.12	0.12	100
Methyl tert-butyl ether	0.93	0.93	0.93	0.93	NS
Methylene chloride	0.05	0.05	0.05	0.05	12

Volatile Organic Compounds (continued)					
Propylbenzene-n	3.9	3.9	3.9	3.9	NS
Sec-Butylbenzene	11	11	11	11	NS
Tert-Butylbenzene	5.9	5.9	5.9	5.9	NS
Tetrachloroethene	1.3	1.3	1.3	1.3	2
Toluene	0.7	0.7	0.7	0.7	36
Trichloroethene	0.47	0.47	0.47	0.47	2
Trimethylbenzene-1,2,4	3.6	3.6	3.6	3.6	NS
Trimethylbenzene-1,3,5	8.4	8.4	8.4	8.4	NS
Vinyl chloride	0.02	0.02	0.02	0.02	NS
Xylene (mixed)	0.26	1.6	1.6	1.6	0.26

All concentrations are in parts per million (ppm)

NS = Not Specified

Footnotes:

¹ The SCO for Hexavalent or Trivalent Chromium is considered to be met if the analysis for the total species of this contaminant is below the specific SCO for Hexavalent Chromium.

² The SCO is the sum of endosulfan I, endosulfan II and endosulfan sulfate.

³ For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.

⁴ This SCO is derived from data on mixed isomers of BHC.

**SOIL EROSION AND SEDIMENT CONTROL PLAN
REMEDIAL CONSTRUCTION ACTIVITIES
OLD ROOSEVELT FIELD CONTAMINATED GROUNDWATER AREA SUPERFUND SITE
GARDEN CITY, NEW YORK**

SUBCONTRACT NO. 3320-023-001-CN-S

Submitted to:

**CDM Federal Engineering
110 Fieldcrest Avenue, 6th Floor
Edison, New Jersey 08837**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher
Lenexa, Kansas 66219**

Revision 0

February 2011

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Construction Schedule
Maintenance Plan

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3-1	Construction Schedule

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	ER-1 Site Erosion and Sediment Control Plan
	ER-2 Erosion Control Details
B	Vegetative Plan

Narrative

Project Description

This document constitutes the Soil Erosion and Sediment Control Plan for services associated with remedial construction activities at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site (ORF) located in Garden City, Nassau County, New York (site). The work involves constructing a groundwater treatment building and associated access road and parking area plus installing underground piping to connect existing extraction wells to the treatment building. The building and parking area will disturb approximately 0.5 acres and installing the underground piping will involve about 2,000 linear feet of trenching. The site is located on the eastern side of Clinton Road, approximately 0.6 mile south of the intersection with Old Country Road. The site location is shown on Figure 1-1

Site Description

The site is a roughly triangular area located at the southwest corner of the Roosevelt Field Mall. The site is bounded by Clinton Road on the west, the mall and the Garden City Plaza (office buildings) on the northeast and municipal property on the south. The center of the triangular area is covered in trees and brush. The trenches will be excavated around the perimeter of this area and the trees and brush will not be impacted. The construction area for the new treatment building, access road, and parking area are located adjacent to the existing Garden City pumping station, water tank, and municipal water wells. The trenching will extend along the edge of the parking lot at the Garden City Plaza, along an emergency access road, and in the grass area east of Clinton Road (known as Hazelhurst Park). The site is generally flat with several small piles of soil located within the area of trees and brush. The site slopes gradually toward the southeast to two stormwater recharge basins.

Adjacent Property

The site is located in a commercial and residential area. The area west of Clinton Road is residential. The area north and east of the site is commercial including the Garden City Plaza office complex and the Old Roosevelt Field Mall. The area south of the site is municipal including the Garden City water tank, pumping station, and two municipal water wells. Two stormwater recharge basins are located east of the water tank area. The eastern basin, Pembroke, is located on property owned by the mall. The basin to the south is Nassau County Recharge Basin number 124. Adjacent property is shown on Figure 1-2.

Soils

The soil in the project area is the Hempstead Series or Urban Land. Urban Land consists of nearly level or gently sloping areas that are covered by buildings, roads, sidewalks, and parking lots. The Hempstead Series consists of very deep, well drained soils on outwash plains. The soils are formed in a loamy

mantle overlying stratified sand and gravel. Slopes range from 0 to 3 percent. A typical soil horizon measured about one quarter mile west of the project site consists of the following:

- A horizon – 0 to 15 inches, black to dark brown silt loam, blocky structure, friable, moderate to many fine roots, moderately to strongly acid.
- B horizon – 15 to 33 inches, yellowish brown silt loam, subangular blocky structure, very friable, few fine roots, strongly acid.
- C horizon – 33 to 60 inches, very pale brown stratified sand and gravel, loose, 60 percent gravel, strongly acid.

This soil well drained with a permeability of 0.6 to 2.0 inches per hour in the topsoil and 6.0 to more than 20 inches per hour in the subsoil. The soil erodibility factor (K) ranges from 0.49 to 0.64 in the surface soil and from 0.10 to 0.20 in the subsoil. The USDA Soil Survey map for the area is shown on Figure 1-3.

Planned Erosion and Sediment Control Practices

Erosion and sediment control measures will be implemented to minimize the transport of sediment off-site and into storm water outfalls. Control measures will include a combination of the methods described below. The Site Supervisor will select the appropriate methods for erosion and sediment control consistent with conditions observed in the field, including topography, drainage features, locations of storm drains, storm water runoff patterns, and sediment content of storm water run off.

Site Preparation

Prior to opening an excavation, the area will be staked or otherwise marked (with spray paint) to indicate the anticipated trench alignment or boundary of the excavation. Excavation boundary staking/marketing will be based upon the design drawings. Trench boundaries and alignment may be adjusted in the field to avoid utilities and other obstructions. Temporary orange plastic construction fence will be erected around the work area to prevent unauthorized access. The limits of the fencing will be modified as necessary to minimize impact to the facility during construction activities. Additionally, warning signs will be posted on all sides of the work area.

Vegetation designated to remain will be protected from damage during activities by erection of suitable barriers, guards and enclosures, or by other approved methods. Site preparation will also include clearing and grubbing of vegetation within work areas and removing concrete/asphalt as necessary to allow construction.

Grassed areas will be prepared by stripping topsoil from areas to be occupied by the treatment buildings, yard piping, structures, and other areas to be excavated. Efforts will be made to not mix topsoil and subsoil during the stripping operation. Topsoil that is suitable for re-use will be stockpiled and protected until it is used during site restoration operations.

Prior to trenching in paved areas, the trench limits will be spray-painted on the pavement surface. The pavement will then be cut along straight lines using a walk-behind concrete saw. Following saw-cutting, the pavement will be broken into manageable pieces using a jack-hammer, chisel, or equivalent equipment. Alternately, the pavement may be pulverized using an excavator or back-hoe with a hydraulic hammer attachment. Concrete rubble will be collected for disposal as Construction and Demolition (C&D) debris. Asphalt rubble will be collected and recycled. Surplus topsoil, clearing and grubbing debris, and pavement debris will be disposed after all work is completed.

Erosion Checks

Baled hay or straw erosion checks will be used as a temporary means for erosion control prior to implementing silt fences and storm water inlet filters. The erosion checks will be used in areas where siltation or water runoff is determined to be a problem, such as along the toe of slopes, ditches, and storm sewer inlets. The bales shall be embedded into the ground 4 to 6 inches, where possible, to prevent water from flowing beneath them. The checks will be removed after they have served their intended purpose.

Temporary Seeding and Mulching

Temporary seeding and mulching shall be used as necessary for areas exposed for more than 14 days to prevent erosion from areas of disturbed ground in areas which were covered by vegetation prior to the commencement of work. During summer and early fall, these areas will be seeded with ryegrass (annual or perennial) at 30 pounds per acre. During winter, these areas will be seeded with winter rye (cereal rye) at 100 pounds per acre. Areas of bare soil or gravel will be restored as shown on the contract drawing.

Diversion Fences

Temporary diversion fences will not be used on this project because the low slope and high infiltration rate of the site soil make it unnecessary to divert water away from an excavation area and into a storm sewer system.

Silt Fences

Temporary silt fences will be installed downgrade of disturbed/exposed areas. The fence material shall be capable of retaining suspended silt particles found in the storm water runoff, as specified in Section 02370, Part 2.4.1 of the contract specifications. The fencing material will be cleaned every storm event or as needed.

Storm Sewer Inlet Filters

Geotextile fabric (with the properties specified in Section 02370, 2.4.1 of the subcontract specifications) shall be placed over storm sewer inlets in areas where construction is being conducted. The inlet filter material will be cleaned every storm event or as needed.

Berms

Protective soil berms will be constructed around the perimeter of open trenches. The berms will be placed in a manner that prevents storm water run-on and run-off from passing through or into the open areas.

Covers

Small piles of soil may be covered with plastic sheeting and secured in place with sandbags if it is anticipated the pile will remain in place for more than 14 days.

Informal daily inspections will be performed in active construction areas to ensure the proper performance of erosion and sediment control features. Informal weekly and as-needed inspections will be made of inactive, unvegetated, disturbed areas to ensure the protectiveness of berms, silt fences, and other control measures. Inspections will be made after each large rainfall and on a daily basis during extensive periods of rainfall.

Seeding

After construction, disturbed areas will be restored by establishing turf in accordance with Section 2900. The soil will be tested for pH, chemical analysis, and mechanical analysis and amended as necessary with lime or fertilizer to meet local growing conditions for the type and variety of turf specified. The soil will be tilled to a minimum depth of 4 inches and the appropriate seed will be applied using broadcast or drill seeding. Details are included in Appendix B – Vegetative Plan.

Grading

All filled areas shall be smoothed and graded to provide a finished surface that is reasonably smooth, compacted to the specified project requirements, free from irregular surface changes, and sloped to drain properly. Grading shall be performed to the lines and grades to match pre-existing conditions, unless otherwise shown on approved design drawings. Grading shall not create swales or areas where ponding of water will occur.

Stone and rock fragments larger than 4-inches in their greatest dimension will be removed from within the top 6-inches of the finished grade of fills and embankments. All loose or protruding rocks in slopes of cut areas will be removed to line or finish grade of the slope. All cut and fill slopes will be uniformly dressed to the slope, cross-section, and alignment shown on approved design drawings.

Dust Control

Releases of dust may occur from trenching, pavement demolition, building construction, site work, truck loading/unloading, and off-hour wind entrainment. The generation of dust and fugitive emissions shall be prevented whenever possible and controlled when necessary. Work practices shall be adjusted in a manner to minimize dust generation. To control dust emissions, both operational and administrative controls will be implemented. The adequacy of dust control will be monitored by visual inspection.

The operational controls that may be implemented include:

- Minimizing material free-fall from excavation equipment (e.g., loaders and excavators) and removing all soil from exterior surfaces of haul trucks
- Following proper decontamination protocols for equipment entering and leaving the site
- Staging trucks for loading on pavement rather than soil, to the extent possible
- Covering and securing loads on haul trucks using tarps
- Water spraying exposed soil during excavation, taking care to avoid overspraying
- Water spraying loads when transporting materials, taking care to avoid overspraying
- Water spraying piles of soil, sand, and gravel
- Covering piles of soil, sand, and gravel with plastic sheeting
- Using paved streets and roads when available
- Water spraying haul routes

Administrative controls that may be implemented include the following:

- Maintaining speed limits on roads
- Visually monitoring ambient dust levels (refer to SSHP)
- Stopping or restricting work activities when dust levels become elevated or when the wind speed is excessive

Maintenance Plan

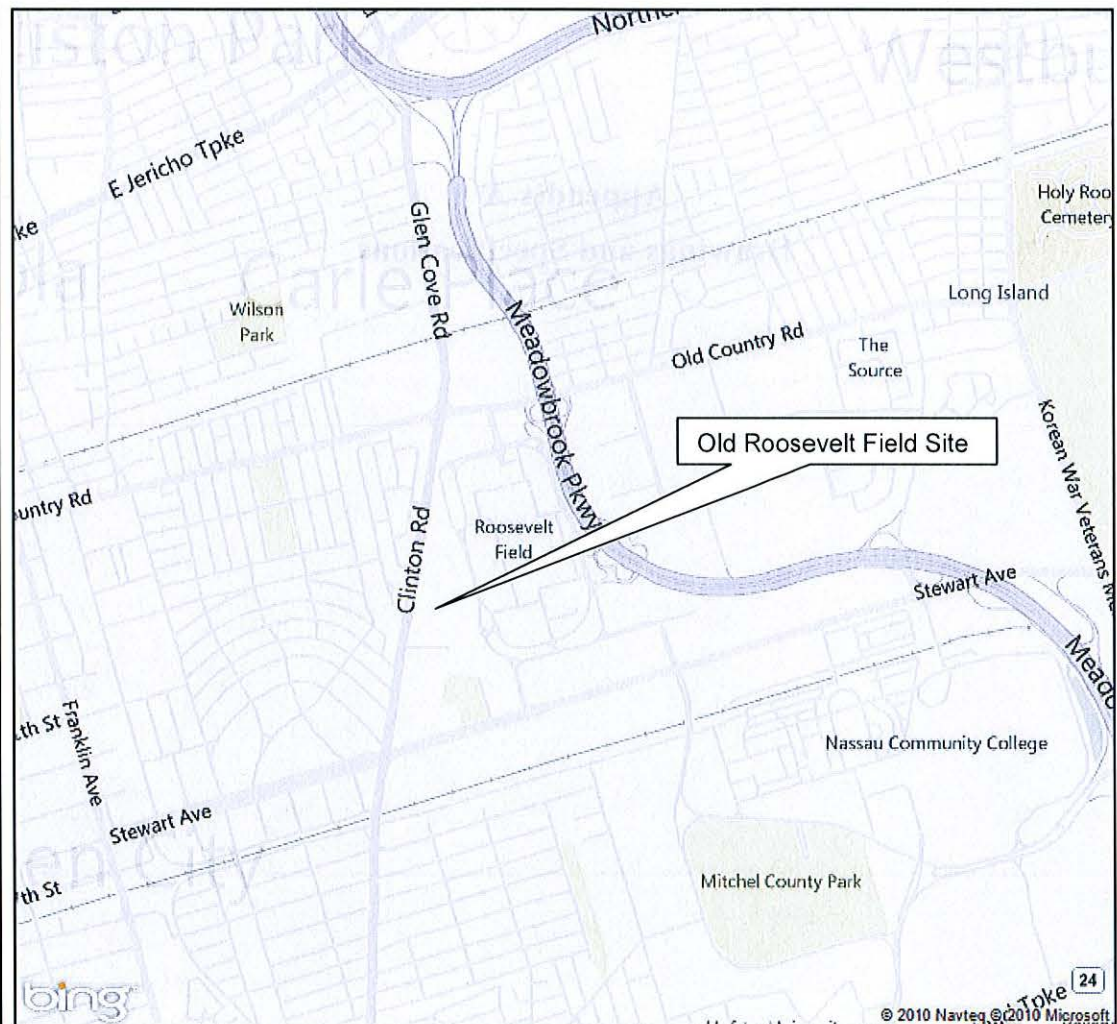
1. All erosion and sediment control practices will be checked for stability and operation following every runoff-producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed and installed for their appropriate phase of the project.
2. All paved surfaces will be cleaned as needed to remove soil that has accumulated during construction operations.
3. Sediment will be removed from the inlet protection structures when storage capacity has been approximately 50% filled and the fabric will be cleaned/replaced when the inlet protection no longer drains properly.
4. All silt fence will be cleaned when sediment becomes approximately 6 inches deep at the fence. The silt fence will be repaired or replaced as necessary to maintain a barrier.
5. All seeded areas will be fertilized, reseeded, and mulched as necessary to maintain a vigorous, dense vegetative cover.

Construction Schedule

Figure 3-1 illustrates the schedule of erosion and sediment control measures in reference to the overall project tasks.

Appendix A

Drawings and Specifications



N
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Figure 1-1

Old Roosevelt Field Contaminated
 Groundwater Area Superfund Site
 Garden City, New York

Vicinity Map

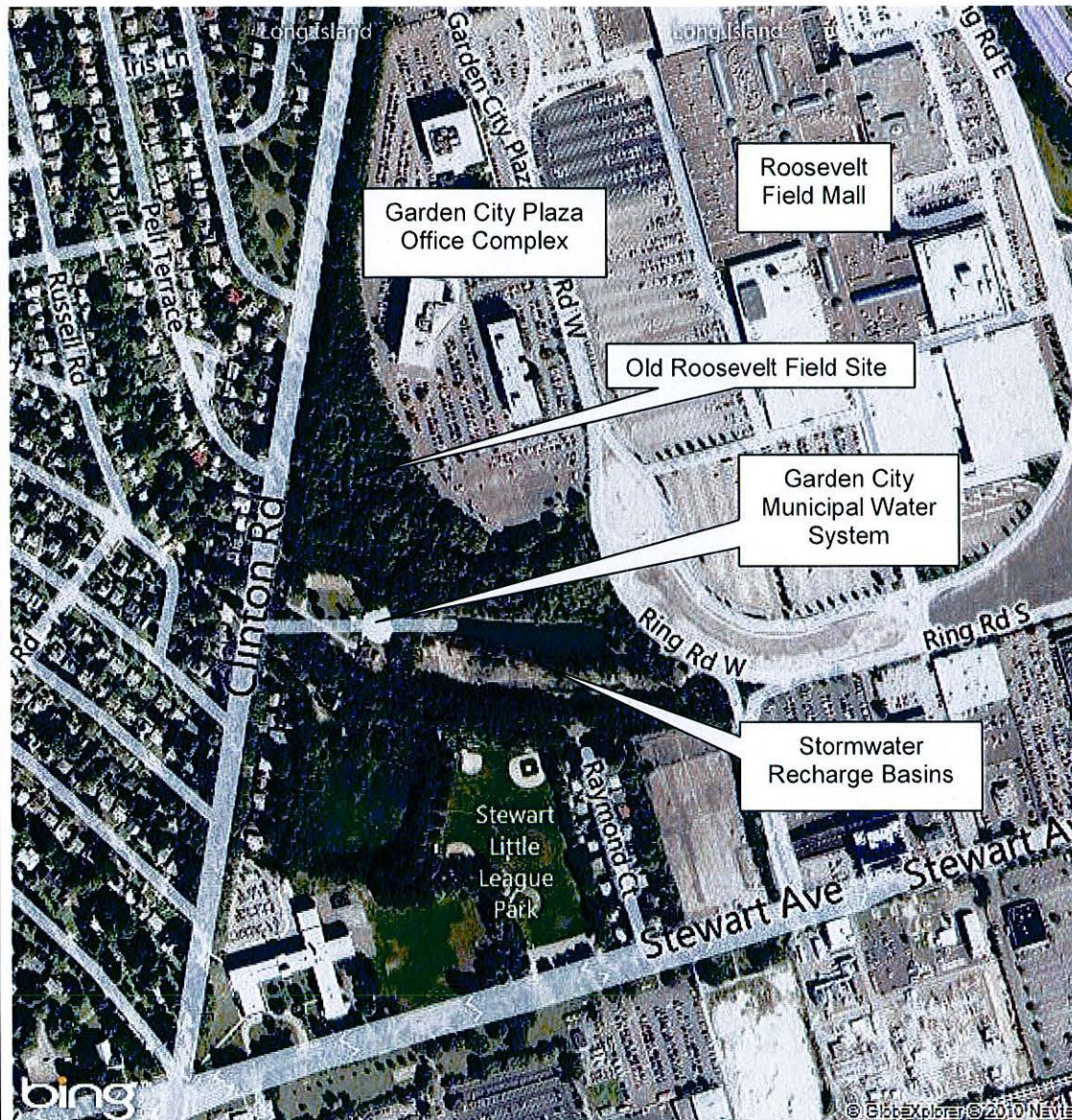


Figure 1-2

Old Roosevelt Field Contaminated
Groundwater Area Superfund Site
Garden City, New York

Adjacent Property Map



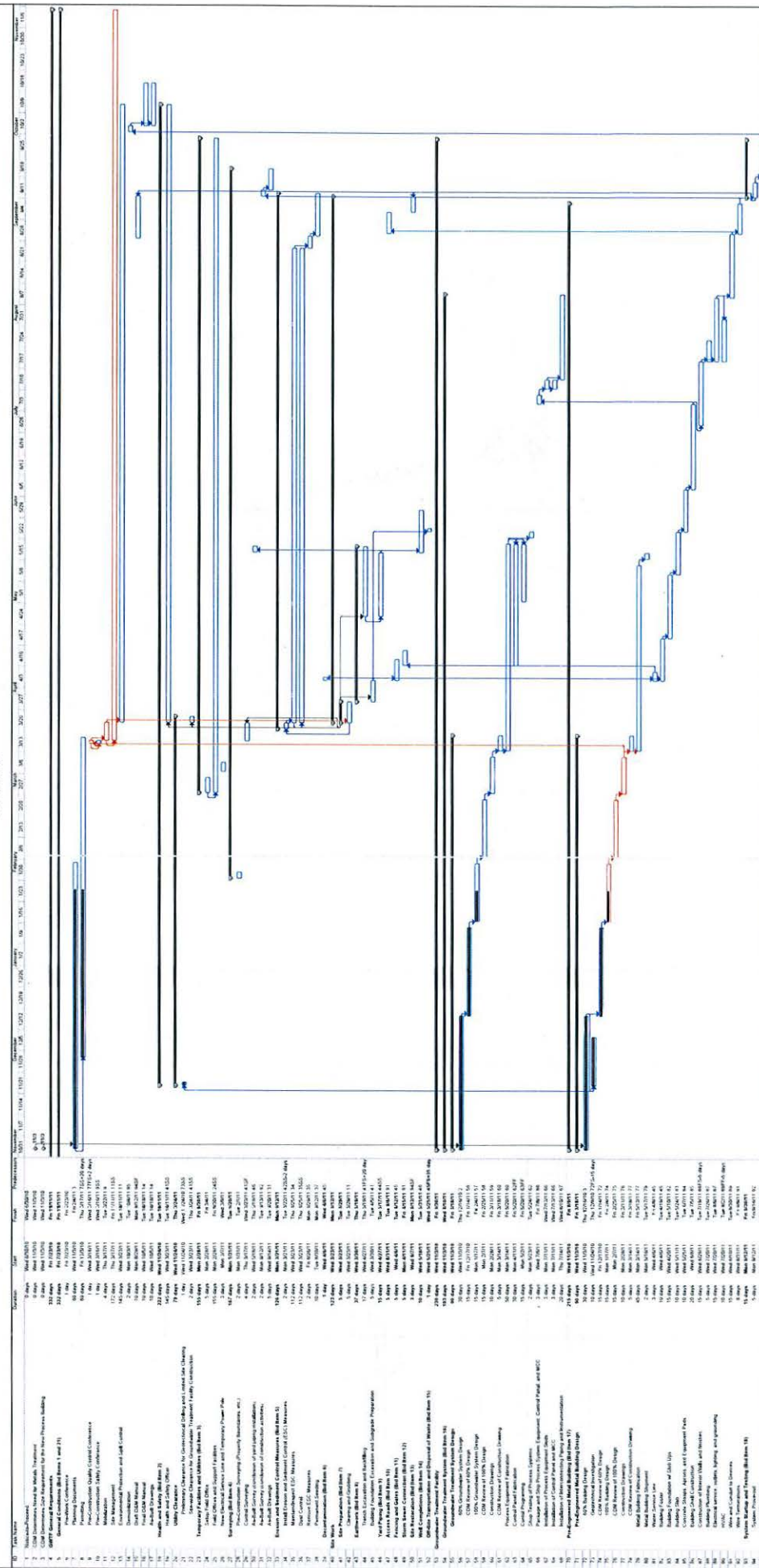
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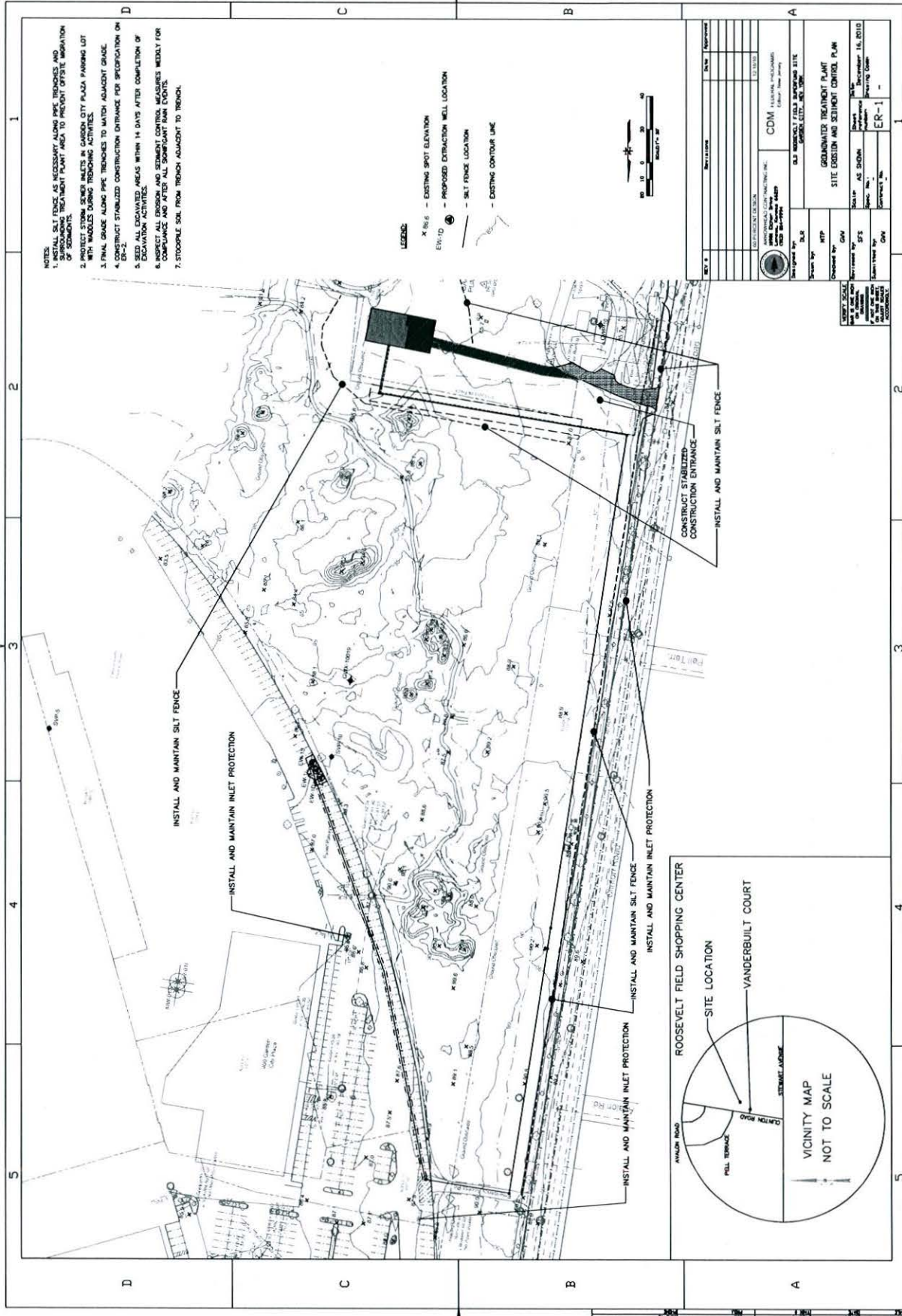
Figure 1-3

Old Roosevelt Field Contaminated
Groundwater Area Superfund Site
Garden City, New York

USDA Soil Survey Map

Figure 3-1





Appendix B

Vegetative Plan

Vegetative Plan

Seedbed Preparation

Grading – backfill to finished grade as indicated on the plan drawings and place topsoil.

Unsatisfactory Environmental Conditions – preparation work will be performed only during periods when beneficial results can be obtained and not during drought, excessive moisture, or other unsatisfactory conditions.

Application of Soil Amendments – a soil test will be performed for pH, chemical analysis, and mechanical analysis to establish the type of amendments required to meet local growing conditions for the type and variety of turf specified

Fertilizer – will be applied as determined by the soil test and will be incorporated into the soil to a minimum of 4 inches or incorporated as part of the tillage.

Lime – Based on the pH test and soil type, lime will be applied at the following rate indicated in the following table.

Initial Soil pH	Sand	Sandy Loam	Loam and Silt Loam	Silty Clay Loam
4.5	1.25	3.0	4.75	6.2
4.6-4.7	1.25	3.0	4.5	6.25
4.8-4.9	1.25	2.75	4.25	6.0
5.0-5.1	1.0	2.5	3.75	5.25
5.2-5.3	0.75	2.0	3.25	4.25
5.4-5.5	0.5	1.5	2.0	3.0
5.6-5.7	0.5	1.0	1.5	2.25
5.8-5.9	0.35	0.75	1.25	1.75
6.0-6.1	0.3	0.75	1.0	1.5
6.2-6.3	0.2	0.5	0.75	1.0
6.4-6.5	0.15	0.35	0.5	0.75
6.6-6.7	0.1	0.25	0.35	0.5

Tillage – to a depth of 4 inches using plowing, disking, harrowing, rototilling or other similar method.

Finished Grading – New surfaces will be graded to 1 inch below the adjoining grade of any surfaced area. New surfaces will be blended to existing areas. The surface will be free of debris

and stones larger than 1 inch. Finished graded areas will be protected from damage by vehicular or pedestrian traffic and from erosion.

Seed Mixtures

Temporary Seed Mixtures – If temporary seeding is necessary to provide cover when permanent seedings are likely to fail due to mid-summer heat or drought, temporary seed species will be as specified by NYSDEC according to season of installation.

Permanent Seed Mixtures – NYSDEC general purpose seed mix (Mix #6), as described in the following table.

Variety	Common Name	Planting Rate (lbs/acre)
Ensylva, Pennlawn, Boreal	Creeping Red Fescue	60
KY-31/Rebel	Tall Fescue	60
Pennfine, Linn	Perennial Ryegrass	15
Empire, Pardee	Birdsfoot Trefoil	30

Seeding Method – do not broadcast seed when the wind velocity is such as to prevent uniform seed distribution.

Applying Seed – apply the seed uniformly at a rate of 3 lbs per 1,000 square feet using a broadcast seeder. Half the seed should be broadcast in one direction and the remainder at right angles to the first direction. Seed will be covered an average depth of ¼ inch by disk harrow, steel mat drag, cultipacker, or other similar device.

Seeding Time – Seed will be sown from March 1 to May 15 or from August 15 to October 1.

Mulch – straw mulch will be applied at a rate of 90 lbs per 1,000 square feet and will be anchored appropriately.

Hay Mulch – cured hay, free of primary noxious weed seeds and rough or woody materials.

Straw Mulch – oat, wheat, rye, barley, or rice stalks free of weeds, mold, and other deleterious material.

Maintenance – will include eradicating weeds, protecting embankments and ditches from erosion, maintaining erosion control materials, and protecting turfed areas from traffic.

Protection of Turfed Areas – immediately after seeding, the area will be protected against traffic or other use by erecting barricades and providing signage as required.

Repair - Turf areas will be reestablished for eroded, damaged, or barren areas.

Mowing - Turfed areas will be mowed to a height of 3 inches when the height of the turf becomes 5 inches. Clippings will be removed when the amount of cut turf is heavy enough to damage the turfed areas.

Watering - will be at intervals to obtain a moist soil condition to a minimum depth of 2 inches. Frequency of watering and quantity of water will be adjusted in accordance with the growth of the turf.

Turf Establishment Period – will be a minimum of 12 weeks after the last day of turfing operations, pending final inspection.

QAPP Worksheet #1
Title and Approval Page

DRAFT REMEDIAL ACTION QUALITY ASSURANCE PROJECT PLAN (RA QAPP)
for
Southern Plume Expansion Remedial Action
and Operation & Maintenance
Old Roosevelt Field Superfund Site
Garden City, New York

US Environmental Protection Agency (EPA) Region 2

Prepared by: Arrowhead Contracting, Inc.
10981 Eicher Dr.
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Date: September 17, 2014

Arrowhead Project Manager:

Doug Ronk, R.G.

Signature_____

Arrowhead Chemical Quality Control Officer

Scott Siegwald, CHMM

Signature_____

CDM Project Manager:

Thomas Matthew, P.E.

Signature_____

CDM Program Manager:

Jeanne Litwin

Signature_____

EPA Region 2 QA Officer:

Sergio Lopez-Luna, P.E.

Signature_____

Site Description

The Old Roosevelt Field Superfund Site is an area of groundwater contamination within the Village of Garden City, in central Nassau County, New York. The site is located on the eastern side of Clinton Road, approximately 0.6 mile south of the intersection with Old Country Road. The site includes a thin strip of open space along Clinton Road (known as Hazelhurst Park), a large retail shopping mall, and several office buildings (including Garden City Plaza) that share parking space with the shopping mall.

Two municipal water supply well fields are located south (hydraulically downgradient of the Site). The Village of Garden City public supply wells (designated at GWP-10 and GWP-11) are located just south of the site boundary, on the eastern side of Clinton Road. The Hempstead well field is located approximately 1.5 miles south of the Garden City supply wells. Two stormwater recharge basins are directly east and south of the mall area. The eastern basin, Pembroke, is located on property owned by the mall. The basin to the south is Nassau County Recharge Basin number 124.

Groundwater at the site is contaminated with volatile organic compounds (VOCs), particularly chlorinated VOCs such as tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), dichlorodifluoromethane and 1,2-dichloroethane (1,2-DCA), and non-chlorinated VOCs such as methyl ter-butyl ether (MTBE). The remedy, as defined in the September 2007 Record of Decision (ROD), involves groundwater extraction and ex-situ treatment (pump and treat) in order to expedite the restoration of water quality in the aquifer in comparison with natural processes alone, and provide for vapor intrusion mitigation, if deemed necessary.

Site History

The Site was used for aviation activities from 1911 to 1951. The United States military began using the Hempstead Plains field prior to World War I to train Army and Navy officers and as a training center for military pilots. In 1918, the Army changed the name of the airfield to Roosevelt Field.

After World War I, the US Air Service authorized aviation-related companies to operate from Roosevelt Field, but maintained control until July 1, 1920, at which time the Government sold its buildings and relinquished control of the field. Subsequently, the property owners sold portions along the southern edge of the field and split the remainder of the property into two flying fields. The eastern half continued as Roosevelt Field, and the western half became known as Curtiss Field. Both fields were bought in 1929 by Roosevelt Field, Inc. and the property was once again called Roosevelt Field.

During World War II, Roosevelt Field was once again used by both the Army and Navy. The Army used the field to provide airplane and engine mechanics training to Army personnel. As of March 1942, there were 6 steel/concrete hangars, 14 wooden hangars, and several other buildings at Roosevelt Field, which were used to receive, fuel, crate and ship Army aircraft. In November 1942, the Navy Bureau of Aeronautics established a modification center at Roosevelt Field to install British equipment into US aircraft for the British Royal Navy. The Navy was responsible for aircraft repair and maintenance, preparation and flight delivery of lend-lease aircraft, and metal work required for installation of British modifications. The facility also performed salvage work of crashed Royal Navy planes. The Navy vacated all but six hangars shortly after the war ended. In August 1946, Roosevelt Field again operated as a commercial airport until it closed in May 1951.

Chlorinated solvents such as PCE and TCE have been widely used for aircraft manufacturing, maintenance, and repair since the later 1930s. Several military instruction manuals for aircraft maintenance and repair were issued during this time period which were specifically related to the use of solvents such as TCE for cleaning airplane parts and for de-icing. The types of airplanes designated for solvents were reportedly present at the Site during World War II. As such, use of chlorinated solvents at the Site was very likely to have occurred.

Soon after the airfield closed, industrial plants for precision electronic instruments were under construction at Roosevelt Field and further development was planned. The large Roosevelt Field Shopping Center was constructed at the site and opened in 1957. Three of the old Navy hangars

remained standing until sometime after June 1971, with various occupants, including a moving/storage firm, discotheque, amusement center, and bus garage.

Garden City installed two public supply wells, GWP-10 and GWP-11 in 1952, at what had been the southwest corner of the airfield. These two wells were put into service in 1953. Over the subsequent years, several other supply wells and cooling water wells were installed and operated the former Roosevelt Field. In the late 1970s and early 1980s, investigations conducted by Nassau County found contaminants TCE and PCE in supply wells GWP-10 and GWP-11. High levels of contamination also were found in cooling water wells at the Site. The Site was listed on the National Priorities List (NPL) on May 11, 2000.

From June 2005 to December 2006, CDM, the Remedial Action Contractor for the Environmental Protection Agency (EPA), performed a remedial investigation (RI) at the Site to investigate the extent of groundwater contamination and to characterize the site geologic and hydrogeologic settings. During the RI, a total of 8 multiport monitoring wells were installed and two rounds of groundwater sampling were collected.

Following the RI, a feasibility study (FS) was completed to evaluate the remediation alternatives to treat the contaminant plume. Based on the findings in the RI and the recommendations in the Final FS, a ROD was signed in September 2007, selecting groundwater extraction and ex-situ treatment technologies to address the Site groundwater contamination.

A groundwater treatment facility was constructed in 2011 which extracts, conveys, and treats via air stripping, water from three groundwater extraction wells. This system operates at an average flow rate of approximately 200gpm. Treated water is discharged to stormwater basin #124 through a storm water inlet located on Clinton Road. To date the treatment facility has extracted and treated approximately 210 million gallons of TCE contaminated groundwater.

Construction Activities

The goal of this project is to complete expansion of the Groundwater Treatment Facility (GWTF). Arrowhead's scope of work includes the following activities:

- Preparing shop drawings
- Obtaining required permits
- Mobilizing to the site
- Preparing the site, including setting up work zones, support areas, and laydown area (i.e. for equipment/vehicle/materials storage), and locating utilities
- Installing site utilities
- Installing GWTF transmission piping and well head construction
- Demolition of selected GWTF equipment
- Installation of new GWTF equipment
- System proveout
- Completion of the Initial Testing Program
- Completing site cleanup/demobilization
- Completing post-construction submittals
- 1 year of Operations and Maintenance

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Appendix A	New York State Department of Conservation, DER-10/Technical Guidance for Site Investigation and Remediation, Appendix 5 – Allowable Constituent Levels for Imported Fill or Soil
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QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project: Old Roosevelt Field Superfund Site
Southern Plume Expansion Remedial Action
and Operation & Maintenance

Site Location: Garden City, New York

Operable Unit: Not Applicable (NA)

RA Subcontractor Name: Arrowhead Contracting, Inc.
Subcontract Number: 3320-048-001-CN

EPA Contractor CDM Federal Programs
Contract Title: Response Action Contract RAC2
Contract Number: EP-W-09-002

Work Assignment Number: 3320.023

Regulatory Program: CERCLA

Approval Entity: EPA Region 2

Is QAPP Generic or Project Specific: Project Specific

Dates of scoping sessions: December 12, 2013

Dates and Titles of QAPP Documents Written for Previous Site Work, if Applicable:

- Final Quality Assurance Project Plan (QAPP), Old Roosevelt Field Contaminated Groundwater Area Site: June 20, 2005;
- Final QAPP Addendum, Old Roosevelt Field Contaminated Groundwater Area Site: October 12, 2005.
- Final QAPP, Old Roosevelt Field Contaminated Groundwater Area Site Remedial Design: March 14, 2008.
- Final QAPP Addendum, Old Roosevelt Field Contaminated Groundwater Area Site Remedial Design: February 12, 2009
- Final QAPP, Old Roosevelt Field Contaminated Groundwater Area Site Remedial Action: May 24, 2010
- Final QAPP, Old Roosevelt Field Contaminated Groundwater Area Site Remedial Action: March 30, 2011

Organizational Partners (stakeholders) and Connection with Lead Organization:

New York State Department of Environmental Conservation (NYSDEC)

Data Users:

CDM Smith, EPA Region 2

Required QAPP elements and required information that are not applicable to the project, and an explanation for their exclusions:

N/A

QAPP Worksheet #2
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheets
Project Management and Objectives		
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**QAPP Worksheet #3
Distribution List**

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address
Sherrel Henry	RPM	US EPA	(212) 637-4273		Henry.Sherrel@epa.gov
Thomas Matthew	Project Manager	CDM Federal Programs	(732) 590-4638	(732) 225-7851	MatthewT@cdmsmith.com
Ali Rahmani	Project Engineer	CDM Federal Programs	(732) 590-4727	(785) 225-7851	RahmaniMA@cdmsmith.com
Greg Wallace	Project Quality Control Manager	Arrowhead Contracting, Inc.	(913) 814-9994	(913) 814-9997	gwallace@arrowhead.org
Doug Ronk	Project Manager	Arrowhead Contracting, Inc.	(913) 814-9994	(913) 814-9997	dronk@arrowhead.org
Joe Cotter	Site Supervisor	Arrowhead Contracting, Inc.	(913) 961-5257	(913) 814-9997	jcotter@arrowhead.org
Rayburn Lavigne	Subcontract Laboratory Project Manager	Test America	(802) 660-1990	(802) 660-1919	Rayburn.Lavigne@testamericainc.com

QAPP Worksheet #4a
Project Personnel Sign-Off Sheet

Organization: Arrowhead

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Greg Wallace	Project Quality Control Manager	(913) 814-9994		
Doug Ronk	Project Manager	(913) 814-9994		
Joe Cotter	Site Supervisor	(913) 961-5257		
Rayburn Lavigne	Subcontract Laboratory Project Manager	(802) 660-1990		

QAPP Worksheet #4b
Project Personnel Sign-Off Sheet

Organization: CDM Federal Programs

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Thomas Matthew	Project Manager	(732) 590-4638		
Ali Rahmani	Project Engineer	(732) 590-4727		

QAPP Worksheet #4c
Project Personnel Sign-Off Sheet

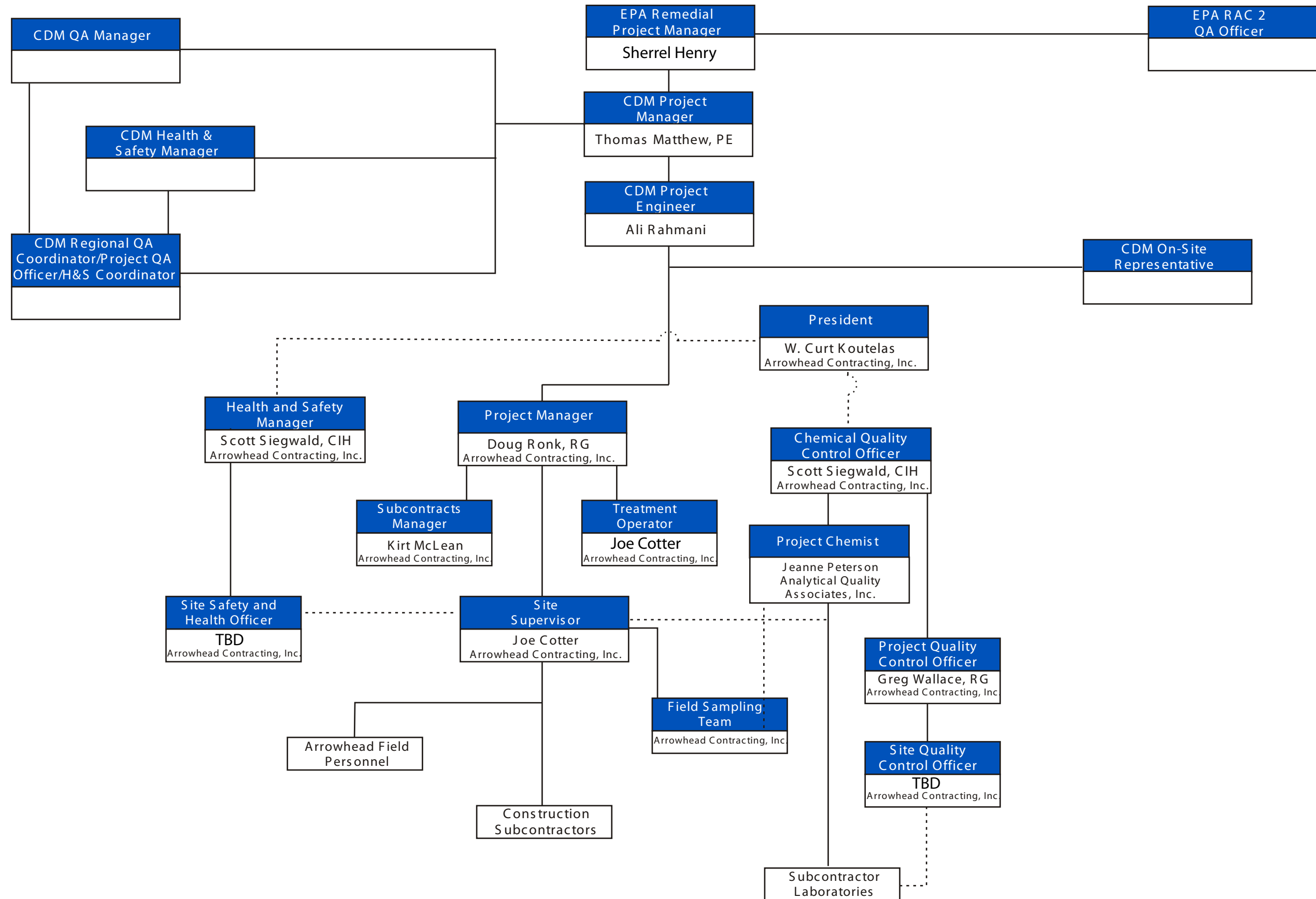
Organization: EPA

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Sherrel Henry	RPM	(212) 637-4273		

QAPP Worksheet #5
Project Organizational Chart

Refer to the attached Project Organization Chart

Figure 2-1
Project Organization Chart



**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Point of Contact with EPA RPM	CDM Project Manager	Thomas Matthew, P.E.	(732) 590-4638	All information about the project will be sent to Sherrel Henry by the CDM PM. Field changes will be discussed with the EPA RPM prior to implementation. Communication as needed.
Manage remedial action activities	Arrowhead Site Supervisor	Joe Cotter	(913) 961-5257	Oversees all construction activities and reports to Arrowhead PM concerning RA activities performed by Arrowhead. Communication to be on a daily basis.
	Arrowhead Project Manager	Doug Ronk	(913) 814-9994	Manages all phases of construction activities. Provides regular updates to CDM PM and PE. Communication to be as needed but not less than weekly.
	CDM Project Engineer	Ali Rahmani	(732) 590-4727	Act as liaison to CDM PM concerning RA activities performed by the Arrowhead. Communication as needed.
	CDM Project Manager	Thomas, Matthew, P.E.	(732) 590-4638	Manages all subcontract personnel and reports progress to EPA. Communication as needed.

**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Change to field work	Arrowhead Site QCO	Clayton Nystrom	(254) 644-2822	Notify CDM On-Site Rep and Arrowhead PM and CQCO delays or changes to field work. Communication to occur within 4 hours of decision change is required.
	CDM On-Site Representative	TBD	TBD	Notify CDM PM and PE of delays or changes to field work. Communication to occur within 4 hours of notice from Arrowhead.
	CDM Project Engineer	Ali Rahmani	(732) 590-4727	Notified by Arrowhead immediately and complete a Field Change Request (FCR) form and/or corrected worksheets. Send FCR forms to RQAC. Notify ASC of delays.
Booking analytical services/Field testing services	Arrowhead Site Supervisor	Joe Cotter	(913) 961-5257	Submit request to Arrowhead PM. Notice to be made within 24 hours (onsite testing) or 7 days (offsite testing).
Field corrective action	Arrowhead Site QCO	Clayton Nystrom	(254) 644-2822	Notify CDM On-Site Rep and Arrowhead PM of delays or changes to field work. Communication to occur within 4 hours of decision change is required.

**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
	CDM Field Representative	TBD	TBD	Notify CDM PM and PE of delays or changes to field work. Communication to occur within 4 hours of notice from Arrowhead.
Analytical support	Arrowhead Chemical Quality Control Officer	Scott Siegwald	(913) 814-9994	Act as liaison with project laboratory.
Analytical data management planning and set-up	CDM Analytical Services Coordinator (ASC)	TBD	TBD	Provide analytical reporting format to the Arrowhead PM
Facilitate Data Management	Arrowhead Chemical Quality Control Officer	Scott Siegwald	(913) 814-9994	Provide electronic sample ID, locations and analyses of collected samples. Transmit completed sample tracking information to PE/RE by the completion of each sampling case. Communication as necessary.
	CDM PE	Ali Rahmani	(732) 590-4727	Notify Arrowhead of any changes required to database to help with reporting to EPA.
Reporting issues related to analytical data quality (i.e. sample integrity, holding time, analytical procedure deviations, corrective action)	Arrowhead Chemical Quality Control Officer	Scott Siegwald	(913) 814-9994	Notify CDM PE of any issues related to data quality

**QAPP Worksheet #6
Communication Pathways**

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Release of Analytical Data	CDM Analytical Services Coordinator (ASC)	TBD	TBD	Receive and review data packages before data is used (only for CLP/DESA). Inform project team of data receipt and status of data.
Site Health and Safety issues	Arrowhead Site Health and Safety Officer	Clayton Nystrom	(254) 644-2822	Make decisions regarding health and safety issues and upgrading personal protective equipment (PPE). Communicate to Arrowhead Corporate HSO, Arrowhead PM, CDM On-Site Rep, and rest of field staff as appropriate. Communication to occur on a daily basis or more frequently as required.
	CDM Field Representative	TBD	TBD	Notify CDM PE and PM of any changes to health and safety protocols or incidences. Communication to occur on a daily basis or more frequently as required.
QAPP Amendments	Arrowhead Site QCO	Clayton Nystrom	(254) 644-2822	Notify CDM PM and PE of need for amendment to QAPP. Communication to occur within 4 hours of notice from Arrowhead.

QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
	Arrowhead Chemical Quality Control Officer	Scott Siegwald	(913) 814-9994	Prepare and submit QAPP Amendment form to CDM and communicate reason for changes as needed.
	CDM Project Engineer	Ali Rahmani	(732) 590-4727	Notified by Arrowhead immediately and complete a QAPP Amendment form and/or corrected worksheets. Send to RQAC. Notify ASC of delays.

QAPP Worksheet #7
Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Thomas Matthew, P.E.	Project Manager	CDM Smith	Manage overall project progress	
Ali Rahmani	Project Engineer	CDM Smith	Review all design submittals and oversee construction	
Jeniffer Oxford	QA Coordinator/Project Chemist	CDM Smith	Review analytical and test data for conformance with specifications and QAPP	
TBD	Field Representative	CDM Smith	Oversee construction activities for conformance with design documents and specifications	
Greg Wallace, R.G. *	Corporate Quality Control Officer	Arrowhead	Corporate Officer with overall responsibility for quality control	B.S. Geology + 30yrs experience. Arrowhead Vice President
Doug Ronk, R.G.*	Project Manager	Arrowhead	Oversee all project aspects	B.S. and M.S. Geology +15yrs experience.
Joe Cotter *	Site Supervisor	Arrowhead	Supervise all construction activities	B.S. Construction Management + 7yrs experience.
Clayton Nystrom *	Site Health and Safety Officer/Quality Control Officer	Arrowhead	Insure compliance with project Health and Safety plan and QAPP	B.S. Environmental Sciences + 12 years experience.
Scott Siegwald, CIH, CSP, CHMM	Corporate Health and Safety Officer	Arrowhead	Maintain communication with site H&S officer and conduct H&S audit as necessary	B.S and M.S. Environmental Engineering + 22yrs experience.
Scott Siegwald, CIH, CSP, CHMM	Chemical Quality Control Manager	Arrowhead	Review analytical data for QA compliance	B.S and M.S. Environmental Engineering + 22yrs experience.

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Activities Personnel entering the Exclusion Zone or Contamination Reduction Zone for excavation work	40-hour OSHA Training and Annual 8 hour refresher	40 hour - EPA or vendor	various	All CDM personnel All Arrowhead and subcontractor personnel that will be potentially exposed to contamination	CDM staff, Arrowhead staff and subcontractor staff	Arrowhead project files at job site and CDM project files at job site, as appropriate
All Field Activities	Site Supervisor Training	Arrowhead Corporate HSO or Vendor	various	Arrowhead Site HSO	Arrowhead Site HSO	Arrowhead project files at job site
Groundwater Treatment Facility (GWTF) Modifications	10-hour OSHA Construction Training	Arrowhead Corporate HSO or vendor	various	Arrowhead staff and subcontractors involved in GWTF construction	Arrowhead staff and subcontractors involved in GWTF construction	Arrowhead project files at job site
All Field Activities	CPR/First Aid	Red Cross or CINTAS	Periodically as required (1 - 3 years)	At least 1 Arrowhead staff on site	At least 1 Arrowhead staff on site	Arrowhead project files at job site
Sample Collection	Trained in EPA Region 2 CERCLA sampling methods, and field testing procedures	On-site training	various	All personnel that performs sample collection	All personnel that performs sample collection	Onsite

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Sample Analysis	Trained in EPA and standard analytical methods	Laboratory and vendor training	various	Test America (Subcontract laboratory) personnel - TBD	Laboratory personnel	Laboratory
Data Validation	Data validation	Subcontractor training	Various	Arrowhead Chemical Quality Control Officer	Arrowhead Chemical Quality Control Officer	Arrowhead Home Office
Data Review/ Assessment	None, performed by experienced chemists	N/A	various	Arrowhead Chemical Quality Control Officer	Arrowhead Chemical Quality Control Officer	Arrowhead Home Office
QA Audits	EPA G-7 auditor training and CDM QA Specialists training	CDM/ASQ/ EPA courses	various	CDM auditors	CDM auditors	CDM
Operation and Maintenance	Minimum 5 years of operation and maintenance experience for comparable treatment systems..	N/A	various	N/A	Arrowhead Operator	Arrowhead Office

QAPP Worksheet #9
Project Scoping Session Participants Sheet

Projected Date(s) of Sampling: Oct 2014 through February 2016		Site Name: Old Roosevelt Field Superfund Site		
Project Manager: Doug Ronk		Site Location: Garden City, NY		
Date of Session: July 23, 2010				
Scoping Session Purpose: Kick-off Meeting				
Name	Affiliation	Phone #	E-mail Address	Project Role
Thomas Matthew, P.E.	CDM	(732) 590-4638	Matthewt@cdm.com	Project Manager
Ali Rahmani	CDM	(732) 590-4727	rahmanimd@cdm.com	Project Engineer
Joe Cotter	Arrowhead	(913) 961-5257	jcotter@arrowhead.org	Site Supervisor
Doug Ronk, R.G.	Arrowhead	(913) 461-3805	dronk@arrowhead.org	Project Manager

Action Items: Arrowhead will begin preparation of Work Plans and begin planning for Site Preparation activities to begin in September 2014.

Consensus Decisions: As described above.

QAPP Worksheet #10 Problem Definition

Problem Summary

The Remedial Investigation (RI) Report, Feasibility Study (FS) report, and Record of Decision (ROD), and Remedial Design (RD) have been completed for the Old Roosevelt Field Superfund Site (Site). The RI/FS identified groundwater contaminated with volatile organic compounds (VOCs), including tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and 1,1-dichloroethene (1,2-DCE). The highest observed concentrations in groundwater derived from RI and Pre-Remedial Design Investigation are as follows:

TCE	960 ug/l
PCE	300 ug/l
1,2 - DCE	69 ug/l
1,1 - DCE	23 ug/l

The ROD indicates that these contaminants pose unacceptable human health and/or ecological risks or exceed regulatory standards and therefore must be remediated through a Remedial Action (RA).

The following major remedial activities will be performed as part of the RA to address groundwater contamination at the Site.

- Construction and operation of a groundwater extraction and treatment system at the Site with discharge of treated water to groundwater through a recharge basin. Groundwater will be treated by air stripping followed by bag filtration. Vapors emitted from the air stripper will be discharged directly to the atmosphere.
- Long-term Operations and Maintenance (O&M) of the groundwater treatment system.

Project Description

The following major activities will be performed in support of the project objectives:

1) Groundwater Treatment System

- Install underground influent and effluent transmission yard piping and complete wellheads
- Demolition of selected groundwater treatment facility (GWTF)
- Installation of new GWTF equipment
- Perform System Startup Testing
- Operate and maintain the groundwater treatment system

Project Decision Conditions

Soil Sampling During Earthwork Construction Activities:

- Soil excavated during trenching or for the well vaults will need to be visually inspected to determine if it meets the criteria in the Specifications and Work Plan for use as on-site backfill. If found unsuitable the soil will be stockpiled and characterized for off-site disposal.
- Imported backfill materials will need to be assessed for composition and cleanliness to ensure it meets the criteria in the Specifications and Work Plan.
- Imported topsoil will be characterized using sampling and laboratory analysis as discussed in the Specifications and Work Plan to ensure that the topsoil meets project requirements.

Start-up Testing:

- Groundwater influent, treated effluent and the air stripper off-gas will be characterized to determine whether the treatment system is meeting specified performance criteria and complies with discharge permit requirements.

Groundwater Treatment System Operation and Maintenance:

- Groundwater influent and treated effluent and the air stripper off-gas will be characterized to determine whether the treatment system is compliance with the discharge permit requirements.

QAPP Worksheet #11
Project Quality Objectives /Systematic Planning Process Statements

Who Will Use the Data?

EPA, NYSDEC, and CDM Smith will use the data.

What Will Data be Used For?

- To confirm achievement of remedial system performance requirements, as specified in the RA subcontract documents (i.e., specifications, drawings, Arrowhead submittals)
- To confirm compliance with the NYSDEC State Pollution Discharge Elimination System (SPDES) permit equivalency and Air Pollution Control permit equivalency
- To obtain data for assessing RA progress and support decisions regarding treatment system O&M and optimization
- To confirm excess excavated/unsuitable soil is not contaminated
- To confirm imported granular material that will be used as backfill meets NYSDEC DER 10, Appendix 5 recommended soil cleanup criteria

What Type of Data is Needed?

The sampling program will include the following:

Soil Sampling For Earthwork Construction Activities

Samples to be analyzed by subcontract laboratory Test America

- Excess/unsuitable excavated material sampling: Target Compound List (TCL) volatile organic compounds (VOCs) and Target Analyte List (TAL) for metals
- Imported Granular Material Sampling: TCL VOCs including benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane, semi-volatiles (SVOCs) including aniline, Pesticides including parathion, polychlorinated biphenyls (PCBs), Herbicides (2,4,5-T, 2,4-D and silvex), and TAL Metals (including mercury)
- Topsoil Sampling: TCL VOCs including benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane, semi-volatiles (SVOCs) including aniline, Pesticides including parathion, polychlorinated biphenyls (PCBs), Herbicides (2,4,5-T, 2,4-D and silvex), TAL Metals (including mercury), grain size, and density testing
- Geotechnical Sampling: Geotechnical samples will be determined by the geotechnical engineer.
See Worksheet #30 for turnaround time (TAT)
Grain size and standard proctor analyses

Groundwater Treatment System

■ Start-up Testing

Samples to be analyzed by subcontract laboratory Test America.

- Influent sampling and monitoring: TCL VOCs, Total Iron, Water quality Parameters (dissolved oxygen (DO), conductivity, pH, oxidation-reduction potential (ORP), turbidity, and temperature).
- Process sampling and monitoring: TCL VOCs, Total Iron, Water Quality Parameters (Worksheet #18)
- Groundwater Effluent Discharge Compliance: Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Oil and Grease, Nitrate and Nitrite, TAL Metals, Total Mercury, Total Cyanide, TCL VOCs, and pH.
- Off-gas system samples: VOCs via TO-15 and screening for VOCs using a photoionization detector (PID)
- Air discharge compliance samples: VOCs via TO-15
- See Worksheet #30 for turnaround time (TAT)
- Continuous water level data using in-situ data loggers will be used to collect the water level data. See Table 3 for which wells continuous water level data will be collected from.

■ Treatment System Operations & Maintenance

Samples to be analyzed by DESA

- Influent Sampling and Monitoring TCL VOCs, Total Iron, Water quality Parameters (worksheet #18).
- Groundwater Effluent Discharge Compliance: Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Oil and Grease, Nitrate and Nitrite, TAL Metals, Total Mercury, Total Cyanide, TCL VOCs, and pH.
- Off-gas system samples collected from the off-gas system exhaust stack sample port: VOCs via TO-15 and screening for VOCs using a PID
- Air discharge compliance samples collected from the system exhaust stack sample port: VOCs via TO-15
See Worksheet #30 for turnaround time (TAT)

QAPP Worksheet #11
Project Quality Objectives /Systematic Planning Process Statements

Waste Disposal Characterization Sampling

Samples to be analyzed by subcontract laboratory Test America.

- The number of samples and analyses will be collected in accordance with the EPA-approved disposal facility.

How “good” do the data need to be in order to support the environmental decision?

The project-specific action limits and quantification limits for each sampled media are specified on Worksheet #15 for all contaminants of potential concern (COPCs). All laboratory analyses will be performed by Arrowhead’s subcontract laboratory, Test America. Data must meet the data quality objectives (DQOs) that have been specified for the site. CDM will review the Arrowhead’s laboratory’s qualifications to confirm that the laboratory is capable of performing the required analyses and that EPA requirements, including certifications, are met. Refer to worksheet 23 for analytical quality requirements.

Where, when, and how should the data be collected?

Figure 2 presents the project schedule. The samples will be collected in the vicinity of the Site. Worksheet #17a-I presents the sampling program design and rationale. Worksheet 18 presents the sampling locations and methods. Worksheet 21 provides the SOPs that govern the various types of sampling. Field Forms are included in Appendix E.

Who will collect and generate the data?

Arrowhead will collect the analytical samples that will be shipped to the laboratory for analysis. Arrowhead will collect backfill and topsoil samples, continuous and synoptic water levels, and samples from the treatment facility. Arrowhead will sample and dispose investigation derived waste (IDW). Laboratory analyses completed for waste characterization, initial testing, and imported fill material will be performed by Arrowhead’s subcontract laboratory, Test America.

- Water samples collected during routine O&M activities will be analyzed by the EPA laboratory, DESA.
- Air samples collected during routine O&M will be analyzed by Arrowhead’s subcontract laboratory, Test America.

How will the data be reported?

Arrowhead will be responsible for data validation of all samples analyzed at the subcontract laboratory. Analytical data will be received in electronic and hard copy. All data generated during construction (i.e. materials testing reports) will be reported to CDM as it is received. EDD and level 4 data packages for chemical analysis will be submitted to CDM as they are received. Data requiring validation will be submitted to the project chemist shortly after receipt from the Test America. Analytical data along with field data will be uploaded to Environmental Quality Information Systems (EQulS) version 5.3.2 by CDM. The database query and reporting tools will be used to create databases as specified by the project team. The reports will be submitted to EPA for review.

- Data generated by DESA is validated prior to delivery to CDM Smith. No further QC review of this data will be completed by Arrowhead.

How will the data be archived?

- Preliminary data will be e-mailed to CDM within the specified turnaround time
- Data from Arrowhead’s subcontract laboratory, Test America, will be received in electronic format specified in the contract and validated by Arrowhead
- Final validated data will be submitted to CDM in electronic format and hard copy consistent with CLP deliverables
- Electronic data will be input into the project’s EQulS database by CDM
- Hard copies of field data including field logs will be archived in the project files
- Hard copies of analytical data received by CDM will be archived in the project files for 10 years after contract expiration

QAPP Worksheet #12a
Measurement Performance Criteria Table

Matrix	Air				
Analytical Group	VOCs				
Concentration Level	Low (ppbv)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Off-gas System Sampling TSOP 1-8	TO-15	Precision	+ 25 % D*	Field Duplicate	S & A
		Accuracy	No analyte > CRQL *, **	Field Blank	S & A
		Precision	+ 25 % D*	Laboratory Replicate Sample	A
		Accuracy	70-130 %R*	Laboratory Audit Standard (LCS)	A
		Accuracy	No analyte > CRQL ***	Laboratory Method Blank	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (ppbv) Detection Limits meet project quantification limit goals (PQLGs)**	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL	MRL	A

1. The subcontract laboratory, Test America, analytical criteria will be outlined in the laboratory SOWS and SOPs.

*Reference Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by GC/MS, 2nd Edition, January 1999; Table 3 "Summary of Internal Quality Control Procedures for VOCs by EPA method TO-15, Revision 01/21/2000.

**Refer to Worksheet 15 for the required quantification limits.

Method Reporting Limit (MRL)

QAPP Worksheet #12b
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TCL VOCs				
Concentration Level	Low (µg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u> <u>Sampling of Excess/Unsuitable Excavated Soils</u>	SOM01.3	Precision	RPD \leq 100% ² ABS \leq 5xCRQL	Field Duplicates ³	S&A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank	A
		Accuracy	See Worksheet #28	LCS	A
		Precision	See Worksheet #28	MS/MSD**	S & A
		Accuracy	See Worksheet #28	***DMCs; MS/MSD**	A
		Completeness	\geq 90%	Data assessment	S&A
		Comparability	Similar Units (µg/kg)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL (ABS \leq 5xCRQL).

3. Only the field duplicate results will be affected since low precision may be due to non-homogenous soils. Data qualifiers will be applied to the field

duplicate samples only.

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 33/ VOCs (SIM/ Low/ Medium) - Blank Type Criteria Table

**Optional MS/MSD – Reference CLP SOM01.3, Exhibit D, and Table 6 for Criteria – Not typically required for Region 2

***Deuterated Monitoring Compounds (DMCs) – Reference CLP SOM01.3, Exhibit D, Table 5 for Criteria

****Imported granular material is any material brought from offsite that will be used for backfill, grading, and miscellaneous site work as specified in Subcontract Specification Section 02300 – Earthwork, and shall include, but not be limited to, common fill, structural fill, select fill, crushed stone, and topsoil.

Method Reporting Limit (MRL)

QAPP Worksheet #12c
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TCL SVOCs				
Concentration Level	Low (µg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	SOM01.3	Precision	RPD $\leq 100\%^2$ ABS $\leq 5 \times \text{CRQL}$	Field Duplicates ³	S&A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank	A
		Precision	See Worksheet #28	MS/MSD ^{**}	S & A
		Accuracy	See Worksheet #28	***DMCs; MS/MSD ^{**}	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units (µg/kg)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL (ABS $\leq 5 \times \text{CRQL}$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 35/SVOCs - Blank Type Criteria Table

**Optional MS/MSD – Reference CLP SOM01.3, Exhibit D, and Table 6 for Criteria – Not typically required for Region 2

***Deuterated Monitoring Compounds (DMCs) – Reference CLP SOM01.3, Exhibit D, Table 5 for Criteria. Method Reporting Limit (MRL)

**QAPP Worksheet #12d
Measurement Performance Criteria Table**

Matrix	Soil				
Analytical Group	TCL Pesticides				
Concentration Level	Low (µg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	SOM01.3	Precision	RPD $\leq 100\%^2$ ABS $\leq 5 \times \text{CRQL}$	Field Duplicates ³	S&A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank, Instrument Blanks	A
		Accuracy	See Worksheet #28	LCS	A
		Precision	See Worksheet #28	MS/MSD**	S & A
		Accuracy	See Worksheet #28	***Surrogates; MS/MSD**	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units (µg/kg)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL (ABS $\leq 5 \times \text{CRQL}$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 36/Low/Medium Pesticide - Blank Type Criteria Table

**MS/MSD – Reference CLP SOM01.3, Exhibit D, and Table 3 for Criteria – Not typically required for Region 2

***Laboratory Control Sample (LCS) – Reference CLP SOM01.3, Exhibit D, Table 2 for Criteria.

Method Reporting Limit (MRL)

QAPP Worksheet #12e
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TCL PCBs				
Concentration Level	Low (µg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	SOM01.3	Precision	RPD $\leq 100\%^2$ ABS $\leq 5 \times \text{CRQL}$	Field Duplicates ³	S&A
		Accuracy	No analyte > CRQL*. ⁴	Field Blank	S & A
		Accuracy	No analyte > CRQL*	Laboratory Method Blank, Instrument Blanks	A
		Precision	See Worksheet #28	MS/MSD**	S & A
		Accuracy	See Worksheet #28	***Surrogate, LCS; MS/MSD**	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units (µg/kg)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL (ABS $\leq 5 \times \text{CRQL}$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 36/Low/Medium Pesticide - Blank Type Criteria Table

**MS/MSD – Reference CLP SOM01.3, Exhibit D, and Table 3 for Criteria – Not typically required for Region 2

***Laboratory Control Sample (LCS) – Reference CLP SOM01.3, Exhibit D, Table 2 for Criteria.

Method Reporting Limit (MRL)

QAPP Worksheet #12f
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TAL Metals				
Concentration Level	low (mg/kg)				
Sampling Procedure	Analytical Method/SO¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u> <u>Sampling of Excess/Unsuitable Excavated Soils</u>	ISM01.3 ICP-AES	Precision	$\leq 100\%$ RPD ^{*,2} ABS $\leq 5 \times$ CRQL	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL [*]	Laboratory Method Blank, Calibration Blanks	A
		Precision	+/- 35% RPD	Laboratory Duplicate Sample **	A
		Accuracy	75-125%	Matrix Spike***	A
		Accuracy	70-130% (50-150% Ag and Sb)	LCS****	A
		Accuracy	<10% Difference	Serial Dilution (ICP)	A
		Sensitivity	70–130%	CRQL	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units ($\mu\text{g/L}$)	Data Review - Compare results from each round	S&A
		Sensitivity	70-130% except Cobalt, Manganese, and Zinc (50-150%). Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWs and SOPs.
2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).
3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
4. See Worksheet #15 for the required quantification limits.

ICP-AES = inductively coupled plasma-atomic emission spectroscopy

*Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Duplicate Sample Criteria

***Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Spike Sample Criteria

****Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Laboratory Control Sample (LCS) .

Method Reporting Limit (MRL)

QAPP Worksheet #12g
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	TAL –Total Mercury				
Concentration Level	low (mg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	ISM01.3 CVAA	Precision	$\leq 100\%$ RPD ^{*.2} ABS $\leq 5 \times$ CRQL	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank, Calibration Blanks	A
		Precision	+/- 35% RPD ²	Laboratory Duplicate Sample **	A
		Accuracy	75–125%	Matrix Spike***	A
		Sensitivity	70–130%	CRQL	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A

		Sensitivity	70-130%. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.
 2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).
 3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
 4. See Worksheet #15 for the required quantification limits.
- *Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP – (include absolute difference criteria)
- **Reference EPA CLP ISM01.3, Exhibit D Mercury for Duplicate Sample Criteria
- ***Reference EPA CLP ISM01.3, Exhibit D Mercury for Spike Sample Criteria.
- Method Reporting Limit (MRL)

QAPP Worksheet #12h
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	Herbicide (2,4,5-T, Silvex, 2,4-D)				
Concentration Level	low (mg/kg)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Imported Granular Material Sampling</u>	SW-846 8151	Precision	$\leq 100\% \text{ RPD}^2$ $\text{ABS} \leq 5 \times \text{CRQL}^*$	Field Duplicate	S & A
		Accuracy	No analyte > QL*	Field Blank	S & A
		Accuracy	No analyte > CRQL*	Laboratory Method Blank, Instrument Blanks	A
		Precision	See Worksheet #28	MS/MSD	S & A
		Accuracy	See Worksheet #28	Surrogate, LCS MS/MSD	A
		Completeness	$\geq 90\%$	Data Assessment	S&A
		Comparability	Similar Units ($\mu\text{g/L}$)	Data Review - Compare results from each round	S&A
		Sensitivity	ICAL at or below RL. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

¹ The subcontract laboratory, Test America, will provide the SOP as part of the procurement.

² RPDs (relative percent difference) will be determined for all detected results. The absolute difference (ABS) will be calculated for all results failing the RPD; where only one result is detected; or one or both results are reported below the quantification limit (QL).

*Refer to Worksheet 15 for the required quantification limits .
Method Reporting Limit (MRL)

QAPP Worksheet #12i
Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	Grain size, Standard Proctor, In-Place Compaction Test				
Concentration Level	Hydrometer				
Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria*	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Onsite Excavated Soil and Imported Granular Material Sampling and Testing of In-Place Compaction of Imported Backfill</u> <u>Testing of Excavated Materials to be Used as On-Site Backfill</u>	ASTM D421-85 & D422-63, ASTM D698, ASTM D1556-07 or D2168-08	Precision/Accuracy	Per ASTM method	Per ASTM method	S & A

² The full range of particles will be reported.

³ Laboratory will be notified of estimated contaminant concentrations for H&S purposes.

QAPP Worksheet #12j
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TCL VOCs				
Concentration Level	Trace (µg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up – Influent/Process/Compliance Sampling</u> <u>O&M – Influent/Process/Compliance Sampling</u>	SOM01.3 Trace Water	Precision	RPD ≤ 25% ² ABS ≤ 5xCRQL	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ⁴	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank	A
		Precision	See Worksheet #28	MS/MSD**	S & A
		Accuracy	See Worksheet #28	***DMCs;LCS MS/MSD**	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A

		Sensitivity	ICAL at or below RL.) Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these measurement performance criteria (MPCs).

4. See Worksheet # 15 for the required quantification limits.

*Reference EPA Region 2 SOP No. 33 for Low/Medium VOA - Blank Type Criteria Table

**Optional MS/MSD – Reference CLP SOM01.3, Exhibit D, and Table 6 for Criteria – Not typically required for Region 2

***Deuterated Monitoring Compounds (DMCs) – Reference CLP SOM01.3, Exhibit D, Table 5 for Criteria.

Method Reporting Limit (MRL)

QAPP Worksheet #12k
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TAL Metals , Total Iron				
Concentration Level	Low (µg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up – Influent/Process/Compliance Sampling</u> <u>O&M – Influent/Process/Compliance Sampling</u>	ISM01.3 ICP-AES	Precision	≤ 20% RPD ^{*,2} ABS ≤ 5xCRQL	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank, Calibration Blanks	A
		Precision	≤ 20% RPD ^{*,2}	Laboratory Duplicate Sample **	A
		Accuracy	75–125%	Matrix Spike***	A
		Accuracy	80-120% Except Ag and Sb	LCS ****	A
		Accuracy	<10% Difference	Serial Dilution (ICP)	A
		Sensitivity	70–130%	CRQL	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A

		Sensitivity	70-130%. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.
 2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).
 3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
 4. See Worksheet #15d for the required quantification limits.
- ICP-AES = inductively coupled plasma-atomic emission spectroscopy
- *Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)
- **Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Duplicate Sample Criteria - (include absolute difference criteria)
- ***Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Spike Sample Criteria
- ****Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Laboratory Control Sample (LCS) Criteria .
- Method Reporting Limit (MRL)

**QAPP Worksheet #12m
Measurement Performance Criteria Table**

Matrix	Groundwater				
Analytical Group	TAL –Total Mercury				
Concentration Level	low (µg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up –Compliance Sampling</u> <u>O&M –Compliance Sampling</u>	ISM01.3 CVAA	Precision	≤ 20% RPD ^{*,2}	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank, Calibration Blanks	A
		Precision	≤ 20% RPD ^{*,2}	Laboratory Duplicate Sample **	A
		Accuracy	75–125% 80-120%	*** Matrix Spike; LCSW****	A
		Sensitivity	70–130%	CRQL	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A

		Sensitivity	70-130%. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A
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1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.
 2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).
 3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
 4. See Worksheet #15 for the required quantification limits.
- *Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)
 **Reference EPA CLP ISM01.3, Exhibit D Mercury for Duplicate Sample Criteria - - (include absolute difference criteria)
 Reference EPA CLP ISM01.3, Exhibit D Mercury for Spike Sample Criteria *Reference EPA CLP ISM01.3, Exhibit D Mercury for solid Laboratory Control Sample (LCS) Note: Control Limits established by EPA for LCS.
 Method Reporting Limit (MRL)

QAPP Worksheet #12m
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TAL –Total Cyanide				
Concentration Level	low (µg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up –Compliance Sampling</u> <u>O&M –Compliance Sampling</u>	ISM01.3	Precision	≤ 20% RPD ^{*,2}	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy	No analyte > CRQL [*]	Laboratory Method Blank	A
		Precision	≤ 20% RPD ^{*,2}	Duplicate Sample **	A
		Accuracy	75–125% 85-115%	*** Matrix Spike; LCSW	A
		Completeness	≥ 90%	Data assessment	S&A
		Comparability	Similar Units (µg/L)	Data Review - Compare results from each round	S&A
		Sensitivity	70-130%. Detection Limits meet project quantification limit goals (PQLGs) ⁴	MRL	A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($ABS \leq 5 \times CRQL$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.

4. See Worksheet #15 for the required quantification limits.

*Reference USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, 2002- (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D Cyanide for Duplicate Sample Criteria - - (include absolute difference criteria)

***Reference EPA CLP ISM01.3, Exhibit D Cyanide for Spike Sample Criteria

Method Reporting Limit (MRL)

QAPP Worksheet #12n
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	Nitrate/Nitrite				
Concentration Level	low (mg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up – Compliance Sampling</u> <u>O&M– Compliance Sampling</u>	353.2	Precision	≤ 25% RPD ² ABS ≤ 5xQL	Field Duplicate	S & A
		Accuracy	No analyte > QL*	Field Blank	S & A
		Precision	≤ 20% RPD*	Laboratory Duplicate Sample	A
		Accuracy	No analyte > QL*	Method Blank	A
		Accuracy	Instrument Performance Check Solution	90-110%	A
		Accuracy	75–125%; 90-110% recovery**	Matrix Spike; LCSW	A
		Completeness	≥ 90%	Data Assessment	S & A
		Comparability	Similar Units (mg/L) Detection limits meet project goals	Data Review	S & A
		Sensitivity	70-130%	MRL	A

¹ The subcontract laboratory, Test America, will provide the SOP as part of the procurement.

² RPDs (relative percent difference) will be determined for all detected results. The absolute difference (ABS) will be calculated for all results failing the RPD; where only one result is detected; or one or both results are reported below the quantification limit (QL).

*Refer to Worksheet 15 for the required quantification limits

**Reference USEPA Method 353.2

Method Reporting Limit (MRL)

**QAPP Worksheet #12m
Measurement Performance Criteria Table**

Matrix	Groundwater				
Analytical Group	Oil and Grease				
Concentration Level	low (mg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria¹	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start-up – Compliance Sampling</u> <u>O&M – Compliance Sampling</u>	1664A	Precision	$\leq 20\%$ RPD ^{*,2}	Field Duplicate ³	S & A
		Accuracy	No analyte > CRQL ^{*,4}	Field Blank	S & A
		Accuracy and Precision	83-101% RPD ≤ 11	Initial Precision and Recovery	A
		Accuracy	No analyte > CRQL ^{*,4}	Laboratory Method Blank	A
		Precision	$\leq 20\%$ RPD ^{*,2}	Laboratory Duplicate Sample *	A
		Accuracy	78-114%*	* Matrix Spike; LCS (ongoing precision and recovery)	A
		Completeness	$\geq 90\%$	Data assessment	S&A
		Comparability	Similar Units ($\mu\text{g/L}$) Detection Limits meet project quantification limit goals (PQLGs) ⁴	Data Review - Compare results from each round	S&A

1. Analytical criteria will be outlined in the laboratory SOWS and SOPs.

2. RPDs (relative percent differences) will be calculated for all detected results. The absolute difference (ABS) will be calculated for results failing the RPD and where only one result is detected or results fall below the CRQL. The ABS will be compared to 5 times the CRQL ($\text{ABS} \leq 5 \times \text{CRQL}$).

3. Only the field duplicate results will be affected by data validation or data assessment actions resulting from failure to achieve these MPCs.
 4. See Worksheet #15 for the required quantification limits.
- *Reference USEPA Method 1664a.

QAPP Worksheet #12o
Measurement Performance Criteria Table

Matrix	Groundwater				
Analytical Group	TDS, TSS				
Concentration Level	low (mg/L)				
Sampling Procedure	Analytical Method/SOP¹	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Start up – Compliance Sampling</u> <u>O&M – Compliance Sampling</u>	Total Dissolved Solids Total Suspended Solids – SM2540C/SM2540D	Precision	≤ 25% RPD ² ABS ≤ 5xQL	Field Duplicate	S & A
		Accuracy	No analyte > QL*	Field Blank	S & A
		Precision	≤ 20% RPD**	Duplicate Sample	A
		Accuracy	No analyte > QL*	Method Blank	A
		Accuracy	85-115% recovery**	LCS	A
		Completeness	≥ 90%	Data Assessment	S & A
		Comparability	Similar Units (mg/L) Detection limits meet project goals	Data Review	S & A

¹ The subcontract laboratory, Test America, will provide the SOP as part of the procurement.

² RPDs (relative percent difference) will be determined for all detected results. The absolute difference (ABS) will be calculated for all results failing the RPD; where only one result is detected; or one or both results are reported below the quantification limit (QL).

*Refer to Worksheet 15 for the required quantification limits**Reference applicable method.

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	Data Source (Originating Organization, Report Title, and Date)	How Data Will Be Used	Limitations on Data Use
Soil and groundwater results collected during the RI investigation	Old Roosevelt Field Superfund Site	CDM Remedial Investigation (2007)	Data used to determine pre-design investigation boring and well locations	None
Groundwater & soil sample results collected during the pre-design investigation	Old Roosevelt Field Superfund Site	CDM Data Evaluation Report (2008)	Data used for additional information required for the Remedial Design (RD).	None
RA Step Test of Extraction Wells	Old Roosevelt Field Superfund Site	CDM (2010)	Data used for the Remedial Action (RA).	None

QAPP Worksheet #14 Summary of Project Tasks

Sampling Tasks: Sampling tasks are summarized below:

Soil Sampling For Earthwork Construction Activities

- Excess excavated material sampling
 - 1 sample per 100 cubic yards (CY) to be shipped offsite
 - See Worksheet #18 for analytical list
- Imported granular material sampling
 - A minimum of one chemical test will be performed per every 5,000 CY of each type of material to be used and no less than one test per borrow area
 - Total number of samples will be determined based on the amount of imported material brought from off-site
 - See Worksheet #18 for analytical list

Groundwater Treatment System

- Start-up (Initial Testing Period (ITP) (see Table 1800-3 in Contract Specifications)
Step 1 – Phase I, Testing Function of Upgraded Process Equipment (Days 1 through 3 of Phase I ITP)
 - System operated at three flow rates, Day 1 = ~175gpm, Day 2 = ~250gpm, Day 3 = ~500gpm.
 - 3 combined influent samples (one sample per day) collected from combined influent sample port, wells EW-1S, EW-1I, and EW-1D in service. SEW wells not in service.
 - 3 compliance samples (one sample per day); collected after the static mixture following caustic injection
 - 1 compliance air sample collected from air stripper exhaust discharge stack during Day 1 of ITP
 - Continuous pH readings following static mixture located after caustic injection
 - Water level reading from data loggers installed in GWX-10019, GWX-10020, MW-01(S-1), and SVP-10
 - Continuous pH reading from probe installed after static mixture located after caustic infection point
 - Continuous flow measurements in line with pipe from each extraction well and after effluent transfer pump
 - See Worksheet #18 for analytical listStep 2 –Phase II, Testing all Three SEW Extraction Wells in Operation (Day 1 of Phase II ITP)
 - 3 discrete influent samples (one sample from each SEW well) collected from extraction vault sampler port of each well
 - 1 combined influent sample collected post bag filter, prior to the air stripper
 - 3 compliance samples (one collected per 15,000 gallons treated)); collected after the static mixture following caustic injection
 - Continuous pH readings following static mixture located after caustic injection
 - Water level reading from data loggers installed in GWX-10019, GWX-10020, MW-01(S-1), and SVP-10
 - Continuous pH reading from probe installed after static mixture located after caustic infection point
 - Continuous flow measurements in line with pipe from each extraction well and after effluent transfer pump
 - See Worksheet #18 for analytical listStep 3- Phase II, Testing While all Six Extraction Wells are in Operation (Days 2 through 10 of Phase II ITP)
 - 4 combined influent samples (one sample on days 2, 3, 4, and 10) collected in the header pipe after the flows from the extraction wells are combined
 - 4 compliance samples (one sample on days 2, 3, 4, and 10); collected after the static mixture following caustic Injection
 - 1 compliance air sample collected from air stripper exhaust discharge stack on Day 3.
 - Continuous pH readings following static mixture located after caustic injection

- Water level reading from data loggers installed in GWX-10019, GWX-10020, MW-01(S-1), and SVP-10
- Continuous pH reading from probe installed after static mixture located after caustic injection point
- Continuous flow measurements in line with pipe from each extraction well and after effluent transfer pump
- See Worksheet #18 for analytical list
- Operation and Maintenance (Year 1)
 - Monthly influent samples collected from the header after the flow is combined from all the extraction wells
 - Weekly monitoring of water quality parameters at influent sample port in header and effluent sampling port after static mixer
 - Weekly compliance samples collected after the static mixture following caustic Injection and analyzed for TDS and TSS
 - Bimonthly compliance samples collected after the static mixture following caustic Injection and analyzed for TCL VOCs and Oil and Grease
 - Monthly compliance samples collected after the static mixture following caustic Injection and analyzed for TAL Metals and Nitrate/Nitrite
 - Quarterly compliance samples collected after the static mixture following caustic Injection and analyzed for Total Cyanide and Total Mercury
 - 39 compliance samples (one sample per week during first six month and then bimonthly thereafter) collected from air stripper exhaust discharge stack
 - Continuous pH readings following static mixture located after caustic injection
 - Continuous pH reading from probe installed after static mixture located after caustic injection point
 - Continuous flow measurements in line with pipe from each extraction well and after effluent transfer pump
 - See Worksheet #18 for analytical list

Waste Disposal Characterization Sampling

- The number of samples and analyses will be collected in accordance with the EPA-approved disposal facility.

Quality Control Tasks:

Soil and water will have one or more of the following QC samples analyzed: field duplicates, matrix spike/matrix spike duplicates, trip blanks, rinsate blanks, and all other QA/QC samples as defined in the method.

Secondary Data:

Secondary data is listed in Worksheet #13. The RI and pre-design investigation data have already been uploaded in the project database. This data was used to refine/confirm the extent of contamination to prepare the remedial design.

Data Management Tasks:

Analytical data will be imported into the EQuIS database after validation. Field measurements will also be added to the database.

Analytical data will be loaded into CDM's EQuIS database.

- Preliminary data will be e-mailed to CDM within the specified turn-around-time.
- Data from Arrowhead's subcontract laboratory, Test America, will be received in electronic format specified in the contract and validated by Arrowhead.
- All final laboratory data will be submitted to CDM in electronic format consistent with CLP deliverables. CDM will review all analytical data.
- Hard copies of analytical data received by CDM will be archived in project file.
- Electronic data will be uploaded into the project's EQuIS database by CDM

- Electronic data will be consistent with EPA Region 2 requirements for electronic data deliverable (EDDs) CDM will forward the EDDs to EPA.
- Electronic analytical data will be archived on CDs and copies of CDs will be forwarded to the USEPA.

Arrowhead is responsible for tracking samples from the point of field collection to submittal for laboratory analysis and the subsequent data validation and data management efforts. The sample handling and custody requirements, including field logs and generation of sample paperwork, sample labels and custody seals (TSOP 1-2) discussed in Worksheets #26 and #27, will be followed. The laboratory QA requirements including laboratory audits and contract compliance screening will be followed according to procedures described below and in Worksheet #23. The

The following information is recorded in the tracking system:

Sample Number

- I. Area of Concern
- II. Sample Matrix
- III. SDG Number
- IV. CLP Case No.
- V. CLP No.
- VI. Analytical Parameter
- VII. Collection Date
- VIII. Shipment Date
- IX. Date Received from Lab
- X. Date Submitted for Data Validation
- VI. Name of Data Validator
- VII. Date of Data Validation Completion
- VIII. Database Entry Date
- IX. Database QC Date
- X. Comments (i.e., MS/D designation, duplicate samples).

Analytical data collected during the field effort will be entered into an EQulS database management system. CDM will establish and maintain an EQulS database for organization and management of the sample data and information collected during the system performance testing of the RA. To facilitate the use of the database, CDM will provide the Arrowhead with a detailed format specification for the delivery of analytical data in an EDD. Once it is uploaded into the database, validated analytical data will be organized, formatted, and input into the database for use in the data evaluation phase.

Reporting

Arrowhead will prepare monthly O&M reports that will include, but is not limited to, summary of operation and maintenance activities, average flow rates, volume of treated water, waste disposal information, level of labor effort, monitoring data and measurements, technical support activities, health and safety activities, utility use quantities and cost and programmable logic controller (PLC) files. Monthly O&M reports will undergo a technical review prior to submission to the CDM. The review will be performed by a qualified reviewer to ensure technical accuracy and conformance with the requirements herein. All calculations, tables, charts, analytical data, and data sheets shall be checked by an independent reviewer. CDM will be responsible for ANSETS reporting.

Documentation and Records:

Information regarding samples will be recorded in site field logs. Any changes that are made to the field logs will be initialed and dated. Documents will be maintained in the project files. Monitoring well purge water data forms will be completed for each sample collected. Chain-of-Custody (COC) and air-bills will also be completed for each sampling event. Calibration logs will be completed for each sampling instrument and maintained in the project files.

Field Change Requests:

In the event that anticipated conditions are different from those encountered once the field work is under way, it may be necessary to implement a deviation from the approved QAPP. When such changes are required, the proposed change will be documented on a field change request (FCR) Form approved by CDM's PM. A copy of the FCR Form is included in Appendix C. A copy of the FCR will be kept on site along with the approved QAPP. A copy of the FCR form will be distributed to the authorizing parties in order to keep all staff informed of the change and to allow oversight of any changes.

When significant field changes occur, the QAPP will be revised. Modifications will be carried out via revised pages to the QAPP. Minor changes will be made through formal memoranda to CDM and will be included as addenda to the QAPP. The complete sign-off procedure will be followed if, in the judgment of CDM, major revisions to the QAPP are required. All revisions to the QAPP will be subject to CDM's internal review process.

QAPP Worksheet #15a
Reference Limits and Evaluation Table – VOC Water

Analyte/Method	CAS Number	Lab Method Detection Limit Water (ug/L)	Method Reporting Limit (ug/L)	Project Quantitation Limit Water (ug/L)	Project Action Level Water (ug/L)
1,1,1-Trichloroethane	71-55-6	0.028	0.5	5	
1,1,2,2-Tetrachloroethane	79-34-5	0.08	0.5	5	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.03	0.5	5	
1,1,2-Trichloroethane	79-00-5	0.073	0.5	1	
1,1-Dichloroethane	75-34-3	0.053	0.5	5	
1,1-Dichloroethene	75-35-4	0.038	0.5	5	
1,2,3-Trichlorobenzene	87-61-6	0.029	0.5	5	
1,2,4-Trichlorobenzene	120-82-1	0.047	0.5	5	
1,2-Dibromo-3-chloropropane	96-12-8	0.25	0.5	0.04	
1,2-Dichlorobenzene	95-50-1	0.051	0.5	3	
1,2-Dichloroethane	107-06-2	0.057	0.5	0.6	
1,2-Dichloropropane	78-87-5	0.053	0.5	1	
1,3-Dichlorobenzene	541-73-1	0.042	0.5	3	
1,4-Dichlorobenzene	106-46-7	0.035	0.5	3	
2-Butanone	78-93-3	0.61	5	NL	
2-Hexanone	591-78-6	0.29	5	NL	
4-Methyl-2-pentanone	108-10-1	0.36	5	NL	
Acetone	67-64-1	0.93	5	NL	
Benzene	71-43-2	0.03	0.5	1	
Bromochloromethane	74-97-5	0.072	0.5	5	
Bromodichloromethane	75-27-4	0.043	0.5	NL	
Bromoform	75-25-2	0.066	0.5	NL	
Bromomethane	74-83-9	0.05	0.5	5	
Carbon disulfide	75-15-0	0.06	0.5	60	
Carbon tetrachloride	56-23-5	0.038	0.5	5	
Chlorobenzene	108-90-7	0.039	0.5	5	
Chloroethane	75-00-3	0.069	0.5	5	
Chloroform	67-66-3	0.047	0.5	7	
Chloromethane	74-87-3	0.097	0.5	5	
cis-1,2-Dichloroethene	156-59-2	0.052	0.5	5	1
cis-1,3-Dichloropropene	110-82-7	0.036	0.5	0.4	0.4

QAPP Worksheet #15a
Reference Limits and Evaluation Table – VOC Water

Analyte/Method	CAS Number	Lab Method Detection Limit Water (ug/L)	Method Reporting Limit (ug/L)	Project Quantitation Limit Water (ug/L)	Project Action Level Water (ug/L)
Cyclohexane	124-48-1	0.04	0.5	NL	NL
Dibromochloromethane	75-71-8	0.047	0.5	NL	NL
Dichlorodifluoromethane	100-41-4	0.025	0.5	5	1
Ethylbenzene	98-82-8	0.05	0.5	5	1
Isopropylbenzene	108-38-3 106-42-3	0.044	0.5	5	1
m,p-Xylene	79-20-9	0.033	0.5	5	1
Methyl acetate	1634-04-4	0.075	0.5	NL	NL
Methyl tert-butyl ether	108-87-2	0.032	0.5	NL	NL
Methylcyclohexane	75-09-2	0.049	0.5	NL	NL
Methylene chloride	95-47-6	0.06	0.5	5	1
o-Xylene	100-42-5	0.041	0.5	5	1
Styrene	127-18-4	0.057	0.5	5	1
Tetrachloroethene	108-88-3	0.051	0.5	5	1
Toluene	156-60-5	0.031	0.5	5	1
trans-1,2-Dichloroethene	10061-02-6	0.018	0.5	5	1
trans-1,3-Dichloropropene	79-01-6	0.031	0.5	0.4	0.05
Trichloroethene	75-69-4	0.054	0.5	5	1
Trichlorofluoromethane	75-01-4	0.052	0.5	5	1
Vinyl chloride		0.049	0.5	2	1

Project action levels are from NYSDEC Surface and Groundwater Quality Standards March 28, 2003
Method reporting limit for SOM 01.2
ug/L – micrograms per liter
NL – Not Listed

QAPP Worksheet #15b
Reference Limits and Evaluation Table – Metals Water

Analyte/Method	CAS Number	Lab Method Detection Limit Water (ug/L)	Method Reporting Limit (ug/L)	Project Quantitation Limit Water (ug/L)	Project Action Level Water (ug/L)
Mercury	7439-97-6	0.015	0.2	0.7	0.5
Aluminum	7429-90-5	40	200	2,000	500
Antimony	7440-36-0	2.6	60	3	2
Arsenic	7440-38-2	2.9	10	25	5
Barium	7440-39-3	13	200	1,000	200
Beryllium	7440-41-7	0.88	5	NL	NL
Cadmium	7440-43-9	0.63	5	5	1
Calcium	7440-70-2	430	5000	NL	NL
Chromium	7440-47-3	0.49	10	50	10
Cobalt	7440-48-4	1.1	50	NL	NA
Copper	7440-50-8	2.9	25	200	40
Iron	7439-89-6	15	100	300	100
Lead	7439-92-1	2.3	10	25	5
Magnesium	7439-95-4	240	5000	NL	NA
Manganese	7439-96-5	0.71	15	300	60
Nickel	7440-02-0	1.2	40	100	40
Potassium	7440-09-7	150	5000	NL	NA
Selenium	7782-49-2	4.5	35	10	7
Silver	7440-22-4	1.6	10	50	30
Sodium	7440-23-5	100	5000	20,000	5,000
Thallium	7440-28-0	3	25	NL	NA
Vanadium	7440-62-2	2.4	50	NL	NA
Zinc	7440-66-6	1.4	60	5,000	500

Project action levels are from NYSDEC Surface and Groundwater Quality Standards March 28, 2003

Method reporting limit for ISM01.2

ug/L – micrograms per liter

QAPP Worksheet #15c
Reference Limits and Evaluation Table – Water

Analyte/Method	CAS Number	Lab Method Detection Limit Water (mg/L) (Typical)	Method Reporting Limit (mg/L)	Project Quantitation Limit Water (mg/L)	Project Action Level Water (mg/L)
Alkalinity	N/A	0.1 - 5.0	TBD	N/A	N/A
Sulfate	N/A	0.0001 - 0.030	TBD	10.0	250
Chloride	N/A	0.05 – 1.0	TBD	5.0	250
Fluoride	N/A	0.01 – 0.2	TBD	0.8	3
Ammonia	N/A	0.02 – 0.05	TBD	0.2	2
Ferrous Iron	N/A	0.03	TBD	0.1	0.6
Hardness	N/A	1.0	TBD	1.0	N/A
TDS	N/A	0.01 – 4.0	TBD	10.0	500
TKN	N/A	0.1 – 0.3	TBD	1.0	10
TOC	N/A	1.0	TBD	1.0	N/A
TSS	N/A	0.004	TBD	1.0	N/A
pH	N/A	2 – 12 SU	TBD	N/A	5.1 to 8.5 SU

Project action levels are from NYSDEC Surface and Groundwater Quality Standards March 28, 2003

mg/L – milligrams per liter

N/A – Not Applicable

TBD – To Be Determined

SU – Standard Units

QAPP Worksheet #15d
Reference Limits and Evaluation Table – Air

Analyte/Method	CAS Number	Lab Method Detection Limit Air (ppbv)	Method Reporting Limit (ppbv)	Project Quantitation Limit Air (ppbv)	Project Action Level Air (ppbv)
Dichlorodifluoromethane	75-71-8	0.012	0.5	0.5	N/A*
1,2-Dichlorotetrafluoroethane	76-14-2	0.012	0.2	0.5	N/A*
Chloromethane	74-87-3	0.021	0.5	0.5	218,600*
Vinyl chloride	75-01-4	0.025	0.2	0.5	N/A*
1,3-Butadiene	106-99-0	0.027	0.2	0.5	N/A*
Bromomethane	74-83-9	0.014	0.2	0.5	N/A*
Chloroethane	75-00-3	0.1	0.5	0.5	N/A*
Trichlorofluoromethane	75-69-4	0.05	0.2	0.5	N/A*
1,1-Dichloroethene	75-35-4	0.015	0.2	0.5	91,300*
Acetone	67-64-1	0.99	5	0.5	N/A*
Isopropyl alcohol	67-63-0	0.043	5	0.5	N/A*
Carbon disulfide	75-15-0	0.05	0.5	0.5	N/A*
Methylene Chloride	75-09-2	0.03	0.5	0.5	N/A*
Methyl tert-butyl ether	1634-04-4	0.013	0.2	0.5	N/A*
trans-1,2-Dichloroethene	156-60-5	0.05	0.2	0.5	N/A*
n-Hexane	110-54-3	0.023	0.2	0.5	N/A*
1,1-Dichloroethane	75-34-3	0.013	0.2	0.5	800*
Methyl Ethyl Ketone	78-93-3	0.064	0.5	0.5	N/A*
cis-1,2-Dichloroethene	156-59-2	0.05	0.2	0.5	81,400*
Chloroform	67-66-3	0.05	0.2	0.5	46*
Tetrahydrofuran	109-99-9	0.1	5	0.5	N/A*
1,1,1-Trichloroethane	71-55-6	0.05	0.2	0.5	1,000.000*
Cyclohexane	110-82-7	0.012	0.2	0.5	N/A*
Carbon tetrachloride	56-23-5	0.05	0.2	0.5	N/A*
Benzene	71-43-2	0.05	0.2	0.5	N/A*
1,2-Dichloroethane	107-06-2	0.015	0.2	0.5	N/A*
n-Heptane	142-82-5	0.027	0.2	0.5	N/A*
Trichloroethene	79-01-6	0.014	0.2	0.5	480*
1,2-Dichloropropane	78-87-5	0.016	0.2	0.5	N/A*
Bromodichloromethane	75-27-4	0.05	0.2	0.5	N/A*

QAPP Worksheet #15d
Reference Limits and Evaluation Table – Air

Analyte/Method	CAS Number	Lab Method Detection Limit Air (ppbv)	Method Reporting Limit (ppbv)	Project Quantitation Limit Air (ppbv)	Project Action Level Air (ppbv)
cis-1,3-Dichloropropene	10061-01-5	0.05	0.2	0.5	N/A*
methyl isobutyl ketone	108-10-1	0.064	0.5	0.5	N/A*
Toluene	108-88-3	0.05	0.2	0.5	N/A*
trans-1,3-Dichloropropene	10061-02-6	0.064	0.2	0.5	N/A*
1,1,2-Trichloroethane	79-00-5	0.05	0.2	0.5	N/A*
Tetrachloroethene	127-18-4	0.017	0.2	0.5	760*
Methyl Butyl Ketone (2-Hexanone)	591-78-6	0.028	0.5	0.5	N/A*
Dibromochloromethane	124-48-1	0.05	0.2	0.5	N/A*
1,2-Dibromoethane	106-93-4	0.012	0.2	0.5	N/A*
Chlorobenzene	108-90-7	0.05	0.2	0.5	N/A*
Ethylbenzene	100-41-4	0.014	0.2	0.5	N/A*
m,p-Xylene	108-38-3 106-42-3	0.023	0.5	0.5	N/A*
o-Xylene	95-47-6	0.05	0.2	0.5	N/A*
Xylene (total)	1330-20-7	0.15	0.2	0.5	N/A*
Styrene	100-42-5	0.05	0.2	0.5	N/A*
Bromoform	75-25-2	0.05	0.2	0.5	N/A*
Cumene	98-82-8	0.05	0.2	0.5	N/A*
1,1,2,2-Tetrachloroethane	79-34-5	0.05	0.2	0.5	N/A*
n-Propylbenzene	103-65-1	0.064	0.2	0.5	N/A*
4-Ethyltoluene	622-96-8	0.064	0.2	0.5	N/A*
1,3,5-Trimethylbenzene	108-67-8	0.064	0.2	0.5	N/A*
1,2,4-Trimethylbenzene	95-63-6	0.064	0.2	0.5	N/A*
1,3-Dichlorobenzene	541-73-1	0.018	0.2	0.5	N/A*
1,4-Dichlorobenzene	106-46-7	0.021	0.2	0.5	N/A*
Benzyl chloride	100-44-7	0.022	0.2	0.5	N/A*
1,2-Dichlorobenzene	95-50-1	0.017	0.2	0.5	N/A*
1,2,4-Trichlorobenzene	120-82-1	0.032	0.5	0.5	N/A*
Hexachlorobutadiene	87-68-3	0.022	0.2	0.5	N/A*

Project action levels are from NYSDEC, Division of Air Resources, Air Guide 1 program
Method reporting limit for TO-15
ppbv – parts per billion by volume
N/A – Not Applicable
* Will be finalized when the air permit is received

QAPP Worksheet #15e
Reference Limits and Evaluation Table – VOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
1,1,1-Trichloroethane	71-55-6	0.2	5	240	Refer to Appendix A
1,1,2,2-Tetrachloroethane	79-34-5	1	5	180	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.1	5	1,800	
1,1,2-Trichloroethane	79-00-5	0.36	5	NL	
1,1-Dichloroethane	75-34-3	0.29	5	60	
1,1-Dichloroethene	75-35-4	0.31	5	120	
1,2,3-Trichlorobenzene	87-61-6	0.19	5	NL	
1,2,4-Trichlorobenzene	120-82-1	0.29	5	1,020	
1,2-Dibromo-3-chloropropane	96-12-8	0.34	5	NL	
1,2-Dichlorobenzene	95-50-1	0.084	5	2,370	
1,2-Dichloroethane	107-06-2	1	5	30	
1,2-Dichloropropane	78-87-5	0.4	5	NL	
1,3-Dichlorobenzene	541-73-1	0.095	5	480	
1,4-Dichlorobenzene	106-46-7	0.18	5	2,550	
2-Butanone	78-93-3	1.6	10	90	
2-Hexanone	591-78-6	2.8	10	NL	
4-Methyl-2-pentanone	108-10-1	0.66	10	300	
Acetone	67-64-1	1.1	10	60	
Benzene	71-43-2	0.3	5	18	
Bromochloromethane	74-97-5	0.35	5	NL	
Bromodichloromethane	75-27-4	1	5	NL	
Bromoform	75-25-2	1	5	NL	
Bromomethane	74-83-9	0.79	5	NL	
Carbon disulfide	75-15-0	0.21	5	810	
Carbon tetrachloride	56-23-5	0.2	5	180	
Chlorobenzene	108-90-7	0.11	5	510	
Chloroethane	75-00-3	0.49	5	570	
Chloroform	67-66-3	0.27	5	90	
Chloromethane	74-87-3	0.69	5	NL	Refer to Appendix A
cis-1,2-Dichloroethene	156-59-2	0.21	5	NL	

QAPP Worksheet #15e
Reference Limits and Evaluation Table – VOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
cis-1,3-Dichloropropene	10061-01-5	0.25	5	NL	
Cyclohexane	110-82-7	0.64	5	NL	
Dibromochloromethane	124-48-1	0.16	5	NL	
Dichlorodifluoromethane	75-71-8	0.21	5	NL	
Ethylbenzene	100-41-4	0.11	5	1,650	
Isopropylbenzene	98-82-8	0.13	5	NL	
m,p-Xylene	108-38-3 106-42-3	0.18	5	360	
Methyl acetate	79-20-9	0.35	5	NL	
Methyl tert-butyl ether	1634-04-4	0.18	5	NL	
Methylcyclohexane	108-87-2	0.24	5	NL	
Methylene chloride	75-09-2	0.32	5	30	
o-Xylene	95-47-6	0.11	5	360	
Styrene	100-42-5	0.13	5	NL	
Tetrachloroethene	127-18-4	0.14	5	420	
Toluene	108-88-3	0.21	5	450	
trans-1,2-Dichloroethene	156-60-5	0.22	5	90	
trans-1,3-Dichloropropene	10061-02-6	0.22	5	NL	
Trichloroethene	79-01-6	0.23	5	210	
Trichlorofluoromethane	75-69-4	0.25	5	NL	
Vinyl chloride	75-01-4	0.29	5	60	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for SOM01.2
ug/Kg – micrograms per kilogram
NL – Not Listed

QAPP Worksheet #15f
Reference Limits and Evaluation Table – SVOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
1,1'-Biphenyl	92-52-4	13	170	NL	Refer to Appendix A
1,2,4,5-Tetrachlorobenzene	95-94-3	14	170	NL	
2,2'-Oxybis(1-chloropropane)	108-60-1	18	170	NL	
2,3,4,6-Tetrachlorophenol	58-90-2	13	170	NL	
2,4,5-Trichlorophenol	95-95-4	15	170	100	
2,4,6-Trichlorophenol	88-06-2	14	170	NL	
2,4-Dichlorophenol	120-83-2	22	170	170	
2,4-Dimethylphenol	105-67-9	9.4	170	NL	
2,4-Dinitrophenol	51-28-5	45	330	330	
2,4-Dinitrotoluene	121-14-2	22	170	NL	
2,6-Dinitrotoluene	606-20-2	18	170	200	
2-Chloronaphthalene	91-58-7	16	170	NL	
2-Chlorophenol	95-57-8	14	170	170	
2-Methylnaphthalene	91-57-6	14	170	7280	
2-Methylphenol	95-48-7	20	170	170	
2-Nitroaniline	88-74-4	29	330	330	
2-Nitrophenol	88-75-5	17	170	170	
3,3'-Dichlorobenzidine	91-94-1	100	170	NL	
3-Nitroaniline	99-09-2	37	330	330	
4,6-Dinitro-2-methylphenol	534-52-1	56	330	NL	
4-Bromophenyl-phenylether	101-55-3	16	170	NL	
4-Chloro-3-methylphenol	59-50-7	16	170	170	
4-Chloroaniline	106-47-8	30	170	170	
4-Chlorophenyl-phenylether	7005-72-3	17	170	NL	
4-Methylphenol	106-44-5	16	170	180	
4-Nitroaniline	100-01-6	27	330	NL	
4-Nitrophenol	100-02-7	35	330	330	
Acenaphthene	83-32-9	14	170	10000	
Acenaphthylene	208-96-8	12	170	8200	
Acetophenone	98-86-2	20	170	NL	Refer to Appendix A
Anthracene	120-12-7	12	170	10000	

QAPP Worksheet #15f
Reference Limits and Evaluation Table – SVOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Atrazine	1912-24-9	17	170	NL	
Benzaldehyde	100-52-7	21	170	NL	
Benzo(a)anthracene	56-55-3	16	170	170	
Benzo(a)pyrene	50-32-8	18	170	170	
Benzo(b)fluoranthene	205-99-2	35	170	220	
Benzo(g,h,i)perylene	191-24-2	7.4	170	10000	
Benzo(k)fluoranthene	207-08-9	12	170	220	
Bis(2-chloroethoxy)methane	111-91-1	15	170	NL	
Bis(2-chloroethyl)ether	111-44-4	14	170	NL	
Bis(2-ethylhexyl)phthalate	117-81-7	25	170	10000	
Butylbenzylphthalate	85-68-7	24	170	10000	
Caprolactam	105-60-2	41	170	NL	
Carbazole	86-74-8	17	170	NL	
Chrysene	218-01-9	21	170	170	
Dibenzo(a,h)anthracene	53-70-3	9.1	170	170	
Dibenzofuran	132-64-9	18	170	1240	
Diethylphthalate	84-66-2	19	170	1420	
Dimethylphthalate	131-11-3	18	170	400	
Di-n-butylphthalate	84-74-2	17	170	1620	
Di-n-octylphthalate	117-84-0	20	170	10000	
Fluoranthene	206-44-0	22	170	10000	
Fluorene	86-73-7	18	170	10000	
Hexachlorobenzene	118-74-1	18	170	170	
Hexachlorobutadiene	87-68-3	18	170	NL	
Hexachlorocyclopentadiene	77-47-4	33	170	NL	
Hexachloroethane	67-72-1	19	170	NL	
Indeno(1,2,3-cd)pyrene	193-39-5	25	170	640	
Isophorone	78-59-1	18	170	880	
Naphthalene	91-20-3	17	170	2800	
Nitrobenzene	98-95-3	20	170	170	Refer to Appendix A
N-Nitroso-di-n-propylamine	621-64-7	10	170	NL	
N-Nitrosodiphenylamine	86-30-6	15	170	NL	

QAPP Worksheet #15f
Reference Limits and Evaluation Table – SVOCs Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Pentachlorophenol	87-86-5	25	330	330	
Phenanthrene	85-01-8	17	170	10000	
Phenol	108-95-2	30	170	170	
Pyrene	129-00-0	14	170	10000	
Aniline (8270C)	62-53-3	35.7	270	100	
Benzoic acid (8270C)	65-85-0	377	1700	810	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for SOM01.2
ug/Kg – micrograms per kilogram
NL – Not Listed

QAPP Worksheet #15g
Reference Limits and Evaluation Table – Pesticides/Herbicides Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Parathion (8270C)	56-38-2	49	330	500	Refer to Appendix A
4,4'-DDD	72-54-8	0.43	3.3	580	
4,4'-DDE	72-55-9	0.39	3.3	420	
4,4'-DDT	50-29-3	1.1	3.3	420	
Aldrin	309-00-2	0.2	1.7	8.2	
alpha-BHC	319-84-6	0.25	1.7	22	
alpha-Chlordane	5103-71-9	0.18	1.7	108	
beta-BHC	319-85-7	0.34	1.7	40	
delta-BHC	319-86-8	0.25	1.7	60	
Dieldrin	60-57-1	0.39	3.3	8.8	
Endosulfan I	959-98-8	0.19	1.7	180	
Endosulfan II	33213-65-9	0.42	3.3	180	
Endosulfan sulfate	1031-07-8	0.47	3.3	200	
Endrin	72-20-8	0.41	3.3	20	
Endrin aldehyde	7421-93-4	0.41	3.3	NL	
Endrin ketone	53494-70-5	0.4	3.3	NL	
gamma-BHC (Lindane)	58-89-9	0.18	1.7	12	
gamma-Chlordane	5103-74-2	0.2	1.7	108	
Heptachlor	76-44-8	0.28	1.7	20	
Heptachlor epoxide	1024-57-3	0.2	1.7	4	
Methoxychlor	72-43-5	1.9	17	NL	
Toxaphene	8001-35-2	24	170	NL	
2,4-D	94-75-7	19	38	100	
4-Nitrophenol	100-02-7	18	36	330	
Pentachlorophenol	87-86-5	1.9	3.8	330	Refer to

QAPP Worksheet #15g
Reference Limits and Evaluation Table – Pesticides/Herbicides Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
2,4,5-T	93-76-5	4.75	9.5	380	Appendix A
Silvex (2,4,5-TP)	93-72-1	1.9	3.8	300	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for SW846 8151 and SOM01.2
ug/Kg – micrograms per kilogram
NL – Not Listed

QAPP Worksheet #15h
Reference Limits and Evaluation Table – Aroclors (PCBs) Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Aroclor-1016	12674-11-2	8.3	33	200	Refer to Appendix A
Aroclor-1221	11104-28-2	8.3	33	200	
Aroclor-1232	11141-16-5	3.7	33	200	
Aroclor-1242	53469-21-9	2.5	33	200	
Aroclor-1248	12672-29-6	2.7	33	200	
Aroclor-1254	11097-69-1	8.3	33	200	
Aroclor-1260	11096-82-5	8.3	33	200	
Aroclor-1262	37324-23-5	8.3	33	200	
Aroclor-1268	11100-14-4	3.5	33	200	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)

Method reporting limit for SOM01.2

ug/Kg – micrograms per kilogram

NL – Not Listed

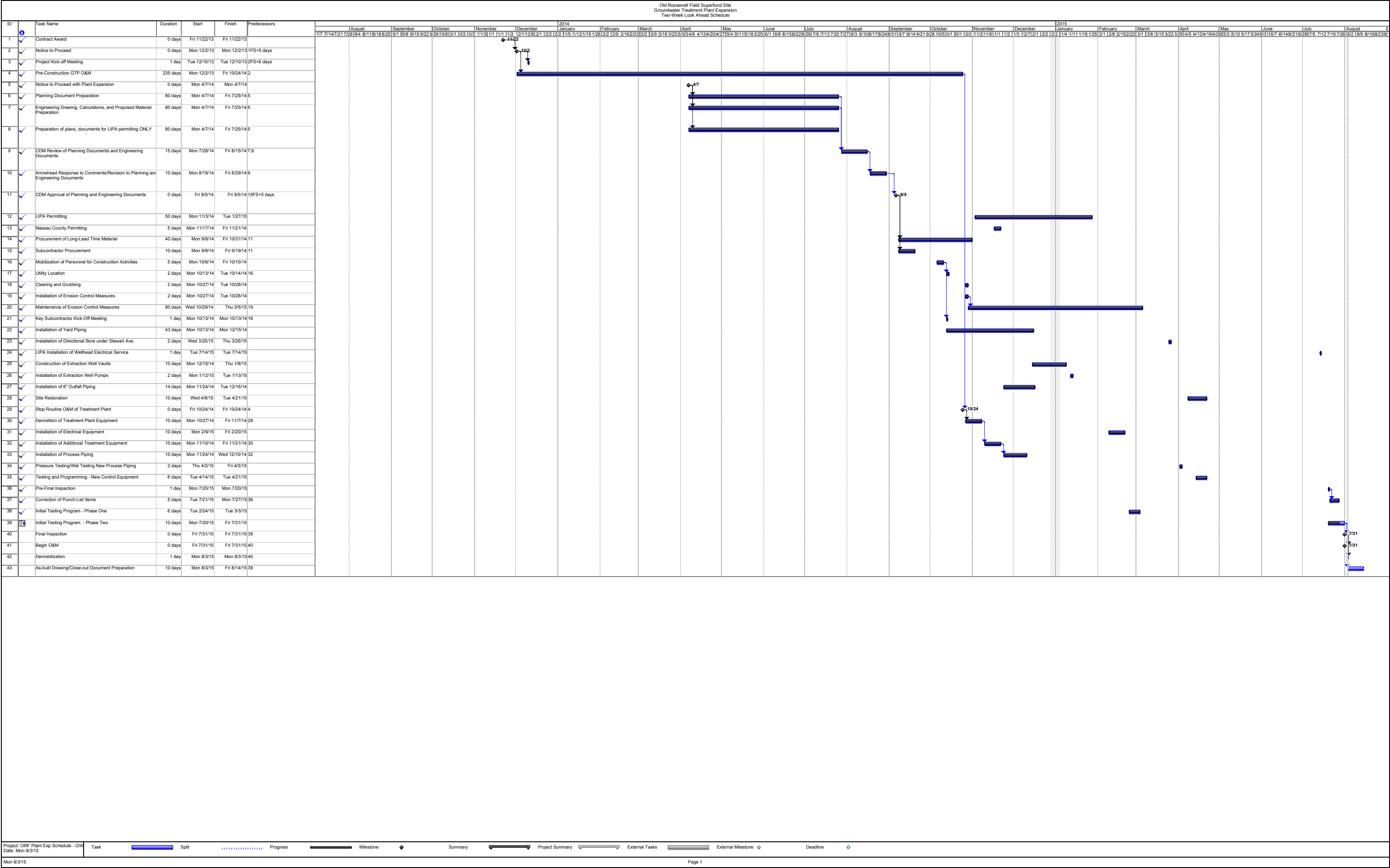
QAPP Worksheet #15i
Reference Limits and Evaluation Table – Inorganics (Metals) Soil

Analyte/Method	CAS Number	Lab Method Detection Limit Soil (ug/Kg)	Method Reporting Limit (ug/Kg)	Project Quantitation Limit Soil (ug/Kg)	Project Action Level Soil (ug/Kg)
Aluminum	7429-90-5	6.4	20	200	Refer to Appendix A
Antimony	7440-36-0	0.34	6	N/A	
Arsenic	7440-38-2	0.27	1	1.5	
Barium	7440-39-3	0.89	20	60	
Beryllium	7440-41-7	0.028	0.5	0.16	
Cadmium	7440-43-9	0.033	0.5	0.5	
Calcium	7440-70-2	7.9	500	N/A	
Chromium	7440-47-3	0.046	1	2	
Cobalt	7440-48-4	0.077	5	6	
Copper	7440-50-8	0.097	2.5	5	
Iron	7439-89-6	1.4	10	400	
Lead	7439-92-1	0.26	1	50	
Magnesium	7439-95-4	6.7	500	N/A	
Manganese	7439-96-5	0.024	1.5	50	
Nickel	7440-02-0	0.22	4	4	
Potassium	7440-09-7	19	500	N/A	
Selenium	7782-49-2	0.28	3.5	2	
Silver	7440-22-4	0.15	1	8	
Sodium	7440-23-5	6	500	N/A	
Thallium	7440-28-0	0.13	2.5	N/A	
Vanadium	7440-62-2	0.12	5	30	
Zinc	7440-66-6	0.85	6	6	
Mercury	7439-97-6	N/A	0.1	0.1	

Project action levels are from New York State Recommended Soil Cleanup Objectives (TAGM #4046, January 1994)
Method reporting limit for ISM01.2
mg/Kg – milligrams per kilogram
N/A – Not Applicable
NL – Not Listed

QAPP Worksheet #16
Project Schedule Timeline Table

Figure 2 Presents the Project Schedule



QAPP Worksheet # 17 Sampling Design and Rationale

Arrowhead's portion of the RA will include demolition of selected GWFT equipment, installation of new GWFT equipment, installation of site utilities, and installation of GWFT transmission yard piping installation of yard piping connecting the extraction wells to a treatment system and O&M of the system. The influent to the GWTF from the extraction wells will be treated by a bag filters followed by an air stripper to reduce CVOC concentrations and remove suspended solids before discharging to a nearby surface recharge basin. The off-gas from the air stripper will be monitored for compliance with NYSDEC requirements and emitted directly to the atmosphere. Samples of the groundwater influent and effluent will be collected and analyzed as part of an Initial Test Period (ITP) to be conducted as part of start-up testing to demonstrate system performance. Sampling of the groundwater influent and effluent and off-gas will also be performed during the ITP and O&M of the GWTF system to ensure compliance with the NYSDEC SPDES discharge permit equivalent and air pollution permit equivalent.

The major elements of the Arrowhead's portion of the RA scope of work that will involve sampling and analysis are summarized below.

- Soil sampling associated with disposal of excess excavated soil and imported borrow material
- Sampling and analysis of groundwater influent and effluent and off-gas from the air stripper during the ITP
- Sampling and analysis of groundwater influent and effluent and off-gas from the air stripper O&M of GWTF

The design and rationale of the RA approach are described in detail in the following worksheets:

- Soil sampling for earthwork construction activities – Worksheet #17a
- Groundwater treatment system
 - Initial testing program – Worksheet #17b
 - Treatment system operation & maintenance – Worksheet #17c

**QAPP Worksheet #17a
Sampling Design and Rationale
Soil Sampling For Earthwork Construction Activities**

Earthwork will be performed in accordance with Contract Specification Section 02300, which includes excavation for building foundation, transformer pad, and well vaults; trenching for pipelines and appurtenance; backfilling and compaction; disposal of surplus and unsuitable material; site grading; and access road construction. Based on Arrowhead's preliminary estimate, approximately 1,800 CY of soil will be excavated as part of the earthwork. We do not anticipate the offsite disposal of any excavated soil. Soil that is found to be unsuitable for backfill (i.e. soil w/ debris) will be stockpiled and characterized for offsite disposal. Waste characterization results will be compared to DER10 criteria.

Excess/Unsuitable Excavated Material Sampling

Soil sampling conducted as part of previous Site investigation in the vicinity of the proposed yard piping and building site has not detected contamination. However, if contaminated soil is found by field screening with a PID and visual inspection for discoloration and/or odor, excess soil is generated, or unsuitable materials are excavated, samples will be collected for waste characterization. The number of samples and analyte list will be determined by the disposal facility requirements. Material which is not suitable for use as structural fill will be used for general site grading in open areas.

Excavated Material used for Backfill Sampling

The samples will be collected from along the yard piping trench and submitted for Standard Proctor and grain size analysis. One sample will be collected from the trench between the extraction wells and the Stewart Avenue, the second sample will be collected along the alignment at the western edge of the Garden City baseball field, and the third sample will be collected along the effluent pipe trench.

Imported Granular Material Sampling

All materials brought offsite to be used as fill and topsoil will be certified clean and tested to ensure they are free from chemical contamination by an offsite laboratory. A minimum of one chemical test will be performed per every 5,000 CY of each type of material to be used and no less than one test per borrow area and analyzed for the following parameters:

- TCL VOCs including benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane
- TAL metals, cyanide, and mercury
- TCL SVOCs including aniline
- TCL PCBs
- TCL Pesticides including parathion
- Herbicide (2,4,5-T, silvex, and 2,4-D)

Field procedures for this activity are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 1-3 Surface Soil Sampling

- TSOP 1-4 Subsurface Soil Sampling (if required)
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 4-1 Field Logbook Content and Control
- Worksheet 17m Decontamination Procedures

**QAPP Worksheet # 17b
Sampling Design and Rationale
Initial Testing Program**

An ITP will be conducted that will consist of a 14-day operational test aimed at demonstrating long-term operability of the system while confirming performance expectations with regard to the contaminant removal. All testing during the ITP will be performed using groundwater. All groundwater treated during this test will be discharged to the recharge basin. During this performance test, the quality of the effluent from the groundwater treatment system may not exceed the limits as required by the NYSDEC SPDES permit equivalent and Air Pollution Control permit equivalent. A copy of the SPDES permit is included in the project specifications.

Table 3, Worksheets #18, #19, and #30, and the following summarize the sampling and analytical requirements during the ITP testing:

Continuous Water Level Measurements

Continuous water level measurements will be collected from water level reading from data loggers installed in GWX-10019, GWX-10020, MW-01(S-I), and SVP-10 the three extraction wells (EW-1S, EW-1I, and EW-1D). Water level measurements will be collected using level transducer and will be used to ensure a set head at the extraction wells. The transducer data from the extraction will be automatically recorded by the PLC. The transducer data from the monitoring wells will be downloaded at the completion of the ITP. The data will be collected to create groundwater elevation iso-contour maps and capture zone estimates. Barometric pressure and rainfall measurements will also be obtained from a local weather station. In addition, water levels will be checked manually with water level probes to provide redundancy in data collection.

Flow Measurements

In-line flow meters will continuously record the flow rate from each extraction well and the effluent leaving the GWTF. The information will be sent to the PLC for visual display and to electronic record files.

Influent Sampling and Monitoring

Influent groundwater samples will be collected from combined influent during each phase of the ITP. During the second phase of the ITP individual samples from each SEW well will be collected along with a combined influent sample. Samples of the influent will be analyzed for TCL VOCs, total iron, and water quality parameters (pH, turbidity, ORP, conductivity, DO, and temperature). The volume of water in the sample port will be purged prior to sample collection. Note that Influent samples will be collected concurrently with the effluent water samples.

Process Sampling and Monitoring

Process samples will be collected from a sample port located after the EQ Tank and bag filters on the first day of the second phase of the ITP. These samples will be analyzed for TCL VOCs, total iron, and water quality parameters (pH, turbidity, ORP, conductivity, DO, and temperature). The volume of water in the sample port will be purged prior to sample collection. Note that the process samples will be collected concurrently with the influent water samples

Compliance Sampling and Monitoring

Compliance sample will be collected from a sample port located after the static mixture that immediately follows the injection point for the caustic. Samples will be collected on day 1 through 3 of the Phase 1 ITP, and on days 1, 2, 3, 4, and 10 of the second phase ITP. Each sample will be analyzed by the subcontract laboratory, Test America, for the following parameters:

- TCL VOCs
- TAL Metals

- Total suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Oil and Grease
- Nitrate and Nitrite (as N)
- Total Mercury
- Total Cyanide

An in-line probe located after the static mixture will provide continuous pH readings. Field measurement of water quality parameters (dissolved oxygen, pH, conductivity, temperature, oxidation-reduction potential, and turbidity) will also be collected with each sample collected.

The volume of water in the sample ports will be purged prior to sample collection.

An in-line probe located after the static mixture will provide continuous pH readings. Field measurement of water quality parameters (dissolved oxygen, pH, conductivity, temperature, oxidation-reduction potential, and turbidity) will also be collected with each sample collected.

The volume of water in the sample ports will be purged prior to sample collection.

Off-gas System Compliance Sampling and Monitoring

Air samples will be collected from the air stripper off-gas line in accordance with TSOP 1-8 and will be collected for VOCs via TO-15. The samples will be collected directly from the treatment system sample port using SUMMA canisters. Flow controllers are not required. Air-tight connection between the SUMMA canister and sample port shall be made using hose barbs and polyethylene tubing (or equal). Air samples will be collected once on Day 1 of the ITP and then once on Days 5 and 10 of the ITP. In addition, the off-gas ports will be screened for VOCs using a PID each time a sample is collected.

Field procedures for this activity are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 1-6 Water Level Measurements
- TSOP 1-8 Volatile Organic Compound Air Sampling Using USEPA Method TO-15 with SUMMA® Canister
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement
- TSOP 2-1 Packaging and Shipping Environmental Samples
- Worksheet #17e Decontamination Procedures
- Worksheet #18 Sampling Locations and Methods/ SOP Requirements

QAPP Worksheet # 17c
Sampling Design and Rationale
Treatment System Operation & Maintenance

The groundwater treatment system will be operated and maintained by Arrowhead in accordance with the O&M manual. Arrowhead will be expected to maintain continuous extraction of water from the extraction wells at the set groundwater elevation in the wells as designated by CDM. The water level data collected from the site wells will be used to determine if hydraulic control is being maintained. Otherwise, the set groundwater elevation in the extraction well may be adjusted with approval from CDM. The GWTF sampling and analysis includes both system and performance/compliance monitoring.

Performance monitoring provides information /data that are used to verify that the treatment system and individual components are operating properly. The information/data will also be used to determine if operational setting refinement is necessary to optimize performance. Operational parameters will be recorded on a routine basis by process controls and by the operator, including extraction well flow rates and totalized flow, influent flow rate and totalized flow, line pressure at all gauges, blower air flow, alarm conditions, and other standard and pertinent operating parameters. Samples will be used to confirm compliance with the NYSDEC SPDES permit equivalency and Air Pollution Control permit equivalency.

System performance sampling will include collecting and analyzing samples from the influent, intermediate and effluent sample ports from the groundwater treatment system to monitor system performance. Effluent samples will be collected in accordance with NYSDEC SPDES permit equivalent and Air Pollution Control permit equivalent requirements. Manual readings of process parameters will also be collected daily to ensure proper operation of the system. The RA Subcontractor will record and maintain all standard and essential information for effective and efficient operation, maintenance, and management of the GWTF, that include but is not limited to, pH, flow rates, temperature, and pressure readings. These manual readings will be performed in accordance with O&M Manual. A summary of the sampling is provided below, in Table 4 and Worksheets #18, #19, and #30.

Continuous Water Level Measurements

Continuous water level measurements will be collected from water level reading from data loggers installed in the three extraction wells (EW-1S, EW-1I, and EW-1D). Water level measurements will be collected using level transducer and will be used to ensure a set head at the extraction wells. The transducer data from the extraction will be automatically recorded by the PLC.

Flow Measurements

In-line flow meters will continuously record the flow rate from each extraction well and the effluent leaving the GWTF. The information will be sent to the PLC for visual display and to electronic record files.

Influent Sampling and Monitoring

Influent groundwater samples will be collected a sample port located in the header pipe after the flow from each extraction well is combined. Samples for TCL VOC and Total Iron analyses will be collected monthly. Samples to be analyzed in the field for water quality parameters (pH, turbidity, ORP, conductivity, DO, and temperature) will be analyzed weekly. The volume of water in the sample port will be purged prior to sample collection. .

Compliance Sampling and Monitoring

Compliance samples of treated groundwater effluent will be collected from a sample port located after the static mixture that immediately follows the injection point for the caustic. The frequency of sampling for each analysis will be as follows:

<u>Analysis</u>	<u>Sampling Frequency</u>
• TCL VOCs	Bimonthly
• TAL Metals	Monthly
• Total suspended Solids (TSS)	Weekly
• Total Dissolved Solids (TDS)	Weekly
• Oil and Grease	Bimonthly
• Nitrate and Nitrite (as N)	Monthly
• Total Mercury	Quarterly
• Total Cyanide	Quarterly

An in-line probe located after the static mixture will provide continuous pH readings. Field measurement of water quality parameters (dissolved oxygen, pH, conductivity, temperature, oxidation-reduction potential, and turbidity) will be performed weekly.

The volume of water in the sample ports will be purged prior to sample collection.

Off-gas System Compliance Sampling and Monitoring

Air samples will be collected from the air stripper off-gas line in accordance with TSOP 1-8 and will be collected for VOCs via TO-15. The samples will be collected directly from the treatment system sample port using SUMMA canisters. Flow controllers are not required. Air-tight connection between the SUMMA canister and sample port shall be made using hose barbs and polyethylene tubing (or equal). Air samples will be collected weekly during the first 6 months of operation and then bimonthly thereafter. In addition, the off-gas ports will be screened for VOCs using a PID each time a sample.

Field procedures for this activity are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 1-6 Water Level Measurements
- TSOP 1-8 Volatile Organic Compound Air Sampling Using USEPA Method TO-15 with SUMMA® Canister
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement
- TSOP 2-1 Packaging and Shipping Environmental Samples
- Worksheet #17e Decontamination Procedures
- Worksheet #18 Sampling Locations and Methods/ SOP Requirements

QAPP Worksheet # 17d
Sampling Design and Rationale
Waste Disposal Characterization Sampling

Waste material generated during this RA may include, but is not limited to, excavated soil determined not to be suitable for backfilling, and construction debris. In order to properly dispose the waste, the waste must first be characterized. All waste characterization sampling and field screening methods will be in accordance with disposal facility requirements and applicable federal, state, and local regulations. Wastes disposed offsite must be disposed of at an EPA-approved disposal facility. Details including handling, storage, and disposal procedures and sampling and analytical requirements for all waste generated during construction and operation, maintenance and monitoring activities will be included in the Waste Management Plan that will be prepared by Arrowhead.

Waste disposal sampling will be performed by collecting representative composite samples from each waste stream that may be potentially hazardous or as required by the EPA-approved disposal facility. Compositing scheme for solid waste samples will be approved by CDM. Waste will be stored in a designated staging area that will be located onsite. All wastes will be segregated as a result of construction and operation activities in accordance with Contract Specification 02120 – OFFSITE TRANSPORTATION AND DISPOSAL and are summarized below:

- Excavated soils identified as contaminated will be segregated as potentially hazardous waste.
- PPE, packaging and shipping materials, construction and demolition debris, and other materials not in contact with contaminated groundwater will be segregated as non-hazardous. This material will be stockpiled and covered or loaded into tarped roll-off containers. Erosion and sedimentation controls will be installed around all stockpiles. To the greatest extent possible waste will be segregated for recycling.
- Wastewater from routine maintenance of the treatment facility and other sources not mixed with contaminated groundwater will be segregated as non-hazardous.
- Construction and demolition debris will be stored in roll-off containers.

Field Procedures for these Activities are detailed in:

- | | |
|------------------|---|
| ■ TSOP 1-2 | Sample Custody |
| ■ TSOP 1-3 | Surface Soil Sampling |
| ■ TSOP 2-1 | Packaging and Shipping Environmental Samples |
| ■ TSOP 2-2 | Guide to Handling Investigation Derived Waste |
| ■ TSOP 4-1 | Field logbook Content and Control |
| ■ Worksheet #17i | Decontamination Procedures |

QAPP Worksheet # 17e
Sampling Design and Rationale
Decontamination Procedures

Decontamination Procedures:

Field decontamination will be performed on all personnel and equipment that enters the exclusion zone. Personnel decontamination procedures will be implemented to prevent worker exposure to site contaminants as explained in the site HASP prepared by the RA Subcontractor. In addition, a separate HASP will be prepared by CDM for oversight work. Decontamination procedures will be implemented to prevent cross-contamination of environmental samples and to prevent off-site migration of contaminants.

Field Monitoring Equipment - Instruments should be cleaned per manufacturer's instructions. The electronic water level indicators, pressure transducer and data logger, electronic water level indicators, and water quality parameter probes will be rinsed with clean water after each use.

Large Pieces of Equipment - All construction equipment that comes in contact with soil must be brushed prior to leaving the site to avoid tracking of these materials into the adjoining public roadways.

Sampling Apparatus – Disposable sampling equipment will be employed to the greatest extent possible. If reusable equipment is necessary all sampling apparatus must be properly decontaminated prior to its use in the field to prevent cross-contamination. Equipment should be decontaminated after usage (once a day or on an as needed basis). The required decontamination procedure for all soil sampling equipment is as follows:

- a. dry brush
- b. non-phosphate detergent rinse (brush as necessary to remove soil on equipment)
- c. tap water* rinse
- d. air dry

Field Procedures for these Activities are detailed in:

TSOP 4-5 Field Equipment Decontamination at Nonradioactive Sites

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number¹	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Soil Sampling During Earthwork Construction Activities							
Excess/unsuitable soil/Refer to Worksheet 26	Soil	Composite from minimum 3 aliquots	TBD by requirements of disposal facility	Standard	TBD	-	See Worksheet #17a
Imported Granular Material Sampling / Refer to Worksheet 26	Soil	NA- Stockpile	Grain size analysis, Standard Proctor, TCL VOCs including benzoic acid, 1,3-dichloropropane, 1,2,3-trichloropropane, TAL Metals (including mercury), TCL SVOCs including aniline, PCBs, Pesticides (including parathion), Herbicides (2,4,5-T, 2,4-D, and Silvex)	Low	1 per 5,000 CY of stockpile	TSOP 1-3	See Worksheet #17a

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number ¹	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Sampling During ITP							
Continuous water level data GWX-10019, GWX-10020, MW-01(S-1), SVP-10, EW-1S, EW-1I, EW-1D, SEW-1S, SEW-1i, and SEW-1D	Groundwater	Water table	Water level data	NA	NA	TSOP 1-6	See Worksheet #17b
Influent Sampling- EW-1S, EW-1I, and EW-1D influent header/ Refer to Worksheet 26	Groundwater	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all other parameters	3 total samples; one sample per day during Days 1, 2, and 3 (zero duplicate)	NA	See Worksheet #17b
Influent Sampling- SEW-1S, SEW-1i, and SEW-1D	Groundwater	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all other parameters	3 total samples; one sample per day during Days 1, 2, and 3 (zero duplicate)	NA	See Worksheet #17b
Influent Sampling- In Header Pipe / Refer to Worksheet 26	Groundwater	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all other parameters	2 total samples; one sample per day on Days 5 and 10 (Zero duplicate)	NA	See Worksheet #17b
Process Sampling after EQ Tank / Refer to Worksheet 26	Treated Groundwater ²	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all others	5 total samples; one sample from each port during Days 1, 2, 3, 5, and 10 (zero duplicate)	NA	See Worksheet #17b

Compliance Sampling after static mixer / Refer to Worksheet 26	Treated Groundwater ²	NA-Port sampling	TCL VOCs, Total Metals, TDS, TSS, Total Mercury, Total Cyanide, Oil and Grease, Nitrate/Nitrite Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all others	5 total samples; one sample from each port during Days 1, 2, 3, 5, and 10 (one duplicate)	NA	See Worksheet #17b
Off-gas System Exhaust Stack sample port	Air	NA-Port sampling	VOCs via TO-15 and PID Screening	Low	5 total samples; 1 sample per day per day; Day 1, 2, 3, 5, and 10	NA	See Worksheet #17b

QAPP Worksheet #18
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number ¹ Sampling Location/ID Number ¹	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Sampling During O&M							
Continuous water level data EW-1S, EW-1I, EW-1D, SEW-1S, SEW-1i, and SEW-1D	Groundwater	Water table	Water level data	NA	NA	TSOP 1-6	See Worksheet #17b
Influent Sampling- In Header Pipe / Refer to Worksheet 26	Groundwater	NA-Port sampling	TCL VOCs, Total Iron, Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all other parameters	One per month for TCL VOCs and Total Iron and once per week for water quality parameters	NA	See Worksheet #17b
Compliance Sampling after static mixer / Refer to Worksheet 26	Treated Groundwater ²	NA-Port sampling	TCL VOCs, TAL Metals, TDS, TSS, Total Mercury, Total Cyanide, Oil and Grease, Nitrate/Nitrite Water Quality Parameters (DO, Conductivity, pH, ORP, turbidity, and Temp)	Trace for VOCs Low for all others	VOCs – 2 per month TAL Metals – Monthly Mercury – Qtrly Cyanide – Qtrly Oil & Grease – 2 per month Nitrate/Nitrite – Monthly Water Quality Parameters - Weekly	NA	See Worksheet #17b

Off-gas System Exhaust Stack sample port/ Refer to Worksheet 26	Air	NA-Port sampling	VOCs via TO-15 and PID Screening	Low	One per week for first 6 months and then twice monthly thereafter	NA	See Worksheet #17b
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1. See Worksheet #17 for a description of the sampling activities
2. Field duplicate quantities are determined based on the total number of samples that will be collected during O&M per matrix.

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical/Preparation Method/SOP Reference¹	Minimum Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time⁴ (preparation/analysis)
Air	VOCs	Low	TO-15	-	SUMMA Canister – 6 L	NA	30 days
Groundwater	TCL VOCs (trace)	Trace	SOM01.3	80 ml	3 X 40 ml vials with Teflon septum	HCl to pH<2; Cool to 4 degrees C. No head space or air bubbles	10 days preserved-VTSR (14 days technical)
Groundwater	TAL metals,	Low	ISM01.3 (ICP-AES, & ICP-MS)	2 liters	2-1 liter polyethylene bottles	HNO ₃ to pH <2; Cool to 4 degrees C	178 days (180 technical); Hg: 26 days-VTSR (28 technical)
Groundwater	Total Mercury	Low	ISM01.3 (CVAA)	NA	See TAL Metals	See TAL Metals	See TAL Metals
Groundwater	Total Cyanide	Low	ISM01.3	1 liter	1- 1 liter polyethylene bottle	NaOH to pH >12; Cool to 4 degrees C	14 days
Groundwater	Oil and grease	Low	1664a	1 liter	1- 1 liter glass bottle	H ₂ SO ₄ or HCl to pH<2; Cool to 4 degrees C.	28 days
Groundwater	TDS	Low	SM 2540C	100 ml	1-250 ml polyethylene bottle	Cool to 4 degrees C	7 days
Groundwater	TSS	Low	SM 2540D	100 ml	1-250 ml polyethylene bottle	Cool to 4 degrees C	7 days
Groundwater	Nitrate/Nitrite	Low	353.2	1 liter	1- 1 liter polyethylene bottle	H ₂ SO ₄ to pH<2; Cool to 4 degrees C.	28 days

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical/Preparation Method/SOP Reference ¹	Minimum Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time ⁴ (preparation/analysis)
Soil	TCL VOCs	Low	5035A/SOM01.3	5 g each	3-40 ml pre-weighed closed system vials with spin bar (weigh the vial before and after adding the sample and record the weights on the COC)	Cool to 4 degrees C	48 hours (on ice) or 10 days (frozen)–VTSR; 40 days analyze
	Percent Moisture (include with VOC vials)	NA	SOM01.3	50 grams	(1) 4 oz. jar w/Teflon lined cap	No preservation No headspace in sample jar	Technical-48 hours
Soil	SVOCs	Low	SOM01.3	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	10 days–VTSR; 40 days analyze; Technical 14/40
Soil	Pesticides	Low	SOM01.3	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	10 days–VTSR; 40 days analyze; Technical 14/40
Soil	PCBs	Low	SOM01.3	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	10 days–VTSR; 40 days analyze; Technical 14/40
Soil	TAL Metals (including mercury and cyanide)	Low	ISM01.3	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	Metals: 178 days; Hg: 26 days; CN: 12 days VSTR
Soil	Herbicide (2,4,5-T, 2,4-D, and Silvex)	Low	SW846 8151	100 g	(1) 8 oz. glass jar w/teflón lined cap	Cool to 4 degrees C	10 days–VTSR; 40 days analyze; Technical 14/40
Soil	Standard Proctor	NA	ASTM D698	3 Gallon	Bucket	NA	NA
Soil	Grain Size	NA	ASTM D421-85 ASTM D422-63	2 Gallon	Bucket	NA	NA

C

Celsius

mL

milliliter

N/A

not applicable

H ₂ SO ₄	Sulfuric Acid	PTFE	Polytetrafluoroethylene	ASTM	American Society of Testing and
Materials					
HCl	Hydrochloric Acid	VTSR	Verified Days to Sample Receipt	HNO ₃	Nitric Acid

1. SOP reference numbers are laboratory specific. This information is maintained by EPA and is not available to EPA contractors.
2. No additional volume is required for MS/MSD analyses for VOC and SVOC analysis.
The field team will consolidate the sample bottles dependent on the type of preservation and laboratories assigned to the wet chemistry analyses.
3. Holding times are from date of collection except for TCL VOC (trace), TCL and TAL analyses. These analyses holding times are from the verified time of sample receipt (VTSR).

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples ⁵	No. of Equipment Blanks	No. of Trip. Blanks
Soil Sampling During Earthwork Construction Activities								
Soil – Excess/unsuitable Material Sampling	TBD by requirements of disposal facility	Standard	TBD by requirements of disposal facility	TBD	0	0	0	0
Soil - Imported Granular Material Sampling	TCL VOCs, TAL Metals (including mercury), TCL SVOCs including aniline, PCBs, Pesticides (including parathion), Herbicides (2,4,5-T, silvex, and 2,4-D)	Low	SOM01.2 ISM01.2 SW846 8151	TBD	TBD			
Groundwater Treatment System								
ITP								
Groundwater – Influent Sampling	TCL VOCs, TAL Metals (including mercury), TSS, TDS	Trace for VOCs, Low	SOM01.3 ISM01.3	Varies 3-8 See Worksheet #14	5 ¹	0 ²	0	14 ³ (for VOCs only)
Groundwater – Process Sampling	TCL VOCs, TAL Metals (including mercury) TSS, TDS	Trace for VOCs, Low	SOM01.3 ISM01.3	Varies 3-8 See Worksheet #14		0 ²	0	
Groundwater treated Effluent – Compliance Sampling	TCL VOCs, TAL metals (including mercury), Cyanide, Mercury, TDS, TSS, Oils and Gas and Nitrate/Nitrite	Trace for VOCs, Low	SOM01.3 ISM01.3, SM 2540C, SM 2540D, 1664a 353.2	Varies 3-8 See Worksheet #14		1 ²	0	

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples⁵	No. of Equipment Blanks	No. of Trip. Blanks
Air – Off-gas System Sampling	VOCs	Low	TO-15	1	1 ¹	NA	NA	NA

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples ⁵	No. of Equipment Blanks	No. of Trip Blanks
Treatment System O&M (Year 1)								
Groundwater – Influent Sampling	TCL VOCs, Total Iron	Trace for VOCs, Low	SOM01.3 ISM01.3	12	1	NA	1	26 ³ (for VOCs only) NA
Groundwater – Compliance Sampling	TCL VOCs	Trace	SOM01.3	26	2	0	0	
Groundwater – Compliance Sampling	TAL Metals	Low	ISM01.3	12	1	1	1	
Groundwater – Compliance Sampling	Total Cyanide	Low	ISM01.3	4	1	1	0	
Groundwater – Compliance Sampling	Total Mercury	Low	ISM01.3	4	1	1	0	
Groundwater – Compliance Sampling	TDS, TSS	Low	SM 2540C SM 2540D	52	3	0	1	
Groundwater – Compliance Sampling	Oil and Grease	Low	1664a	26	2	0	0	
Groundwater – Compliance Sampling	Nitrate/Nitrite	Low	353.2	39	2	0 ²	0	
Air – Off-gas Compliance Sampling	VOCs	Low	TO-15	39	2	NA	NA	

1. Field duplicate quantities are determined based on the total number of samples that will be collected during ITP activity per matrix.
2. Extra volume will be collected for QC. The number of QC analysis will be shared based on the total number of samples that will be collected during ITP activity per matrix, a minimum of 1 per 20 primary samples
3. Number of trip blanks was determined based on the total number days/shipments VOC samples will be shipped during the ITP activity.
4. Field duplicate quantities are determined based on the total number of samples that will be collected during O&M activity per matrix.
5. Extra volume will be collected for QC. The number of QC analysis will be shared based on the total number of samples that will be collected during O&M per matrix, a minimum of 1 per 20 primary samples.
6. Number of trip blanks was determined based on the total number days/shipments VOC samples will be shipped during O&M.
7. Additional volume will be collected.

*No field quality control associated with the field measurement.

**As required determined by the RA Subcontractor

QAPP Worksheet #21
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
1-2	Sample Custody, Rev. 5, 3/31/07	CDM Smith	NA	Y	-Sample tags are not required. --Distribution of COCs as per EPA Region 2 guidelines -Use waterproof ink for any handwritten labels.
1-3	Surface Soil Sampling	CDM Smith		Y	See note 1
1-6	Water Level Measurement, Rev. 6, 3/31/07	CDM Smith	Section 4 of TSOP	N	
1-8	Volatile Organic Compound Air Sampling using USEPA Method TO-15 with SUMMA Canister	CDM Smith		N	
1-9	Tap Water Sampling	CDM Smith		Y	Only Section 5 – 5, 6, 10, 12 and 13 applies
1-10	Field Measurement of Organic Vapors, Rev. 4, 3/31/07	CDM Smith	Section 4 of TSOP Mini-RAE	N	
2-1	Packaging and Shipping Environmental Samples, Rev. 3, 3/31/07	CDM Smith	Section 1.3 of TSOP	Y	-Methanol will not be used. -Vermiculite shall not be used.
3-1	Geoprobe® Sampling, Rev. 5, 3/31/07	CDM Smith		N	
3-5	Lithologic Logging	CDM Smith		N	

QAPP Worksheet #21
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
4-1	Field Logbook Content and Control, Rev. 6, 3/31/07	CDM Smith	NA	Y	Logbook notes should include decon procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/PM/Project Geologist. Details of samples collected including CLP numbers and visual observations.
4-2	Photographic Documentation of Field Activities, Rev. 7, 3/31/07	CDM Smith	Camera	N	
4-5	Field Equipment Decontamination at Nonradioactive Sites, Rev. 7, 3/31/07	CDM Smith	Section 4 of TSOP	Y	See Worksheet #17i -Use phthalate-free gloves
4-10	Borehole and Well Decommissioning	CDM Smith		N	
5-1	Control of Measurement and Test Equipment, Rev. 8, 3/31/07	CDM Smith	NA	Y	Leased or rented equipment only to be used.
Appendix A	Site-Specific Low Flow Groundwater Purging And Sampling Procedure	CDM Smith	Section IV of SOP	N	
Contract Specificication 01550	Surveying	CDM Smith		N	

Notes:

1. Homogenization – The process of mixing individual grab samples in order to minimize the bias in sample representativeness introduced by the natural stratification of constituents within the sample. Homogenization of soil is accomplished by thoroughly mixing the collected soil with a stainless steel spoon or spatula in the following manner. The soil should be scraped from the stainless steel container sides, corners, and bottom, then rolled into the middle and initially mixed. The soil is then quartered and moved to the four quarters of the container. Each quarter of the

sample should be mixed individually, then rolled to the center of the stainless steel container and mixed again.

Method for Collecting Surface Soil Samples for VOC Analysis in Closed-System Vials

1. Use the appropriate decontaminated stainless steel or Teflon sampling device to collect the sample.
2. Retrieve the sampling device and slowly decant off any liquid phase.
3. Complete the sample label by filling in the appropriate information. Do not cover the label with tape.
4. Place the tared or pre-weighed, pre-labeled 40-ml VOA vial and cap on the scale.
5. With the aid of a clean stainless steel spatula, quickly add 5 grams of soil to the vial.
6. Immediately secure the Teflon-lined cap on the sample container.
7. Repeat the procedure for the remaining two vials.
8. Collect percent moisture sample in a 40-ml VOA vial or 60-ml jar with Teflon sealed cap. Fill the entire sample container with soil, no headspace.
9. Store samples at 4 degrees Celsius, and ship the sample to the analytical laboratory. The sample must be received by the laboratory within 48 hours of sample collection.

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Mini RAE Dual PID Toxic Gas Monitor with 11.7 eV lamp	Calibration checked at the beginning and end of day	As needed in field; semi-annually by supplier	Measure known concentration of Isobutylene 100 ppm (calibration gas)	Upon receipt, Successful operation	Calibrate am, check pm	± 10% of the calibrated value	Manually zero meter or service as necessary and recalibrate	Arrowhead	Manufacturer's specifications
Water Quality Meter	Calibrate at the beginning of the day and check calibration at the end of the day	Performed before shipment and as needed	Measure solutions with known values (National Institute for Standards and Technology (NIST) traceable buffers and conductivity calibration solutions)	Upon receipt, Successful operation	Daily, before each use	pH: ± 0.05 Specific Conductivity :±5 micro Siemens (µS) DO ± 0.02 ppm Temp.: ±0.3°C	Recalibrate or service as necessary	Arrowhead	Manufacturer's specifications
Turbidity Meter	Calibrate daily before each use	As needed	Measure solutions with known turbidity standards	Upon receipt, Successful operation	Daily prior to use	N/A (instrument zeroed)	Manually zero or service as necessary and recalibrate	Arrowhead	Manufacturer's specifications
Continuous Water Logger	Manufacture Calibration only	Performed by manufacture or prior to shipping	Manufacture Calibration only	Check instrument is in working order	Performed by manufacture or prior to shipping	Pass/Fail	Return to vendor or rental company for replacement	Arrowhead	Manufacturer's specifications

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Water Level Meter	N/A	None	Check daily, before each use	Check instruments are in working order	Check daily before each use	Pass/Fail	Return to rental company for replacement	Arrowhead	Manufacturer's specifications
pH Meter	Daily buffer checks (2 point bracketing sample pH)	None	Recheck; replace buffer solutions and recheck. If still fails perform instrument check or place out of service	Check instruments are in working order	Check daily before each use	± 0.1 pH units or ± 0.05 pH units	Return to rental company for replacement	Arrowhead	Manufacturer's specifications

Note:

Equipment model determined by Arrowhead and approved by CDM
All sampling equipment will be supplied by Arrowhead
Permanent transducers will be government owned property.

QAPP Worksheet #23
Analytical SOP References Table

Reference Number(1)	Title, Revision, Date, and/or No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Project Work Modified (Y/N)
SOM01.3	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis; April 2007 amendment	Definitive	TCL VOCs Trace for groundwater Low for Soil	GC/MS	Test America	Y, Add benzoic acid, 1,3-dichloropropane , 1,2,3-trichloropropane for imported granular material sampling
SOM01.3	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis; April 2007 amendment	Definitive	TCL SVOCs	GC/MS	Test America	Y, Add aniline
SOM01.3	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis; April 2007 amendment	Definitive	TCL Pesticides	GC/ECD	Test America	Y, Add parathion
SOM01.3	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis; April 2007 amendment	Definitive	TCL PCBs	GC/ECD	Test America	N
ISM01.3	CLP SOW for Multi-Media, Multi-Concentration Inorganic Analysis; January, 2010	Definitive	TAL Metals	ICP-AES / ICP-MS	Test America	N
ISM01.3	CLP SOW for Multi-Media, Multi-Concentration Inorganic Analysis; January, 2010	Definitive	Mercury	CVAA	Test America	N

QAPP Worksheet #23
Analytical SOP References Table

Reference Number(1)	Title, Revision, Date, and/or No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Project Work Modified (Y/N)
ISM01.3	CLP SOW for Multi-Media, Multi-Concentration Inorganic Analysis; January, 2010	Definitive	Cyanide	Spectrometer	Test America	N
TO-15	Compendium Method TO-15	Definitive	VOC	GC/MS	Test America	N
SM 2540C	MCAWW. Revised 1992	Definitive	TDS	Balance, oven	Test America	N
SM 2540D	MCAWW. Revised 1992	Definitive	TSS	Balance, oven	Test America	N
1664a	revision A (February 1999): N-HEXANE EXTRACTABLE MATERIAL (HEM; OIL AND GREASE) AND SILICA GEL TREATED N-HEXANE EXTRACTABLE MATERIAL (SGTHEM; NON-POLAR MATERIAL) BY EXTRACTION AND GRAVIMETRY	Definitive	Oil and Gas	Balance, oven	Test America	N
353.2	Revision 2 (August 1993): DETERMINATION OF NITRATE-NITRITE NITROGEN BY AUTOMATED COLORIMETRY	Definitive	Nitrate/Nitrite	Flow Injection Analyzer	Test America	N
ASTM D698	Standard Practice for Dry Preparation of Soil Samples. 2002	Definitive	Standard Proctor	Compaction Molds	Subcontractor laboratory	N
ASTM D421-85	Standard Practice for Dry Preparation of Soil Samples. 2002	Definitive*	Grain Size	Sieves, hydrometer	Subcontractor laboratory	N
ASTM D422-63	Standard Test Method for Particle-Size Analysis of Soils. 2002	Definitive*	Grain Size	Sieves, hydrometer	Subcontractor laboratory	N

QAPP Worksheet #23
Analytical SOP References Table

Reference Number(1)	Title, Revision, Date, and/or No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Project Work Modified (Y/N)
8151	Chlorinated Herbicides by GC using Methylation or Pentafluorobenzoylation Derivation, Rev 1, December 1996	Definitive	Herbicides	GC	Test America	N
8141	Organophosphorus Compounds by Gas Chromatography: Capillary Column Technique, Rev 1, September 1994	Definitive	Parathion	GC	Test America	N

1. Arrowhead Subcontractor's laboratory specific SOPs will be submitted under separate cover.

*Data will not be validated.

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Instruments used for TO-15 follow the calibration frequencies outlined in the selected laboratory's method SOP.						
GC/MS	See TO-15 Initial calibration (ICAL):	Upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met.	Relative response factor (RRF) ≥ 0.01 for 2-butanone; carbon disulfide; chloroethane; chloromethane; 1,2-dibromoethane; 1,2-dichloropropane; 1,2-dibromo-3-chloropropane; and methylene chloride. For all other compounds, RRF $\geq 0.05^*$; Percent relative standard deviation (%RSD) must be $\leq 30\%^*$. Area response at each calibration level within $\pm 40\%$ of the mean.*	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate.	Laboratory GC/MS Technician	TO-15
	Continuing calibration:	Following initial calibration verification, once every 12 hours, end of run.	RRF ≥ 0.01 for 2-butanone; carbon disulfide; chloroethane; chloromethane; 1,2-dibromoethane; 1,2-dichloropropane; 1,2-dibromo-3-chloropropane; and methylene chloride.	Inspect system, recalibrate the instrument, and reanalyze samples.		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			For all other compounds, RRF $\geq 0.05^*$; Percent difference (%D) within $\pm 30\%^*$.			
	GC/MS Tuning:	Tune with 4-Bromofluorobenzene (BFB): Beginning of each 12 hour period during which standards and samples are analyzed.	See ion abundance table (Table 3) in TO-15.	Inspect the system, identify problem. MS tune criteria must be met before calibration		
	Retention Time Evaluation:	Each analysis.	Relative retention time (RRT) must be within 0.06 RRT units of mean RRT from ICAL.*	Re-calibrate and verify, re-analyze samples back to the last good calibration check verification		

*Refer to method TO-15 and/or EPA Region II SOP HW-31.

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS VOCs See SOM01.3	Initial calibration (ICAL): 5 point standards	Upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met.	RRF ≥ 0.05 (≥ 0.01 for poor responders and DMCs); %RSD for all target compounds $\leq 30\%$ ($\leq 40\%$ for poor responders and $\leq 50\%$ for 1,4-dioxane) or correlation coefficient > 0.995 if alternate curve is used.	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate.	Laboratory GC/MS Technician	SOM01.2
	Continuing calibration verification (CCV)	Once every 12 hours; opening and closing CCVs must be run within same 12 hours	RRF ≥ 0.05 (≥ 0.01 for poor responders and DMCs); %D $\leq 30\%$ ($\leq 40\%$ for poor responders).	Inspect system; correct problem; recalibrate the instrument, reanalyze samples and standards.		
	Calibration Standards Verification	Each lot of standards	As per lab established control limits	Inspect system; correct problem; re-run standard and affected samples		
	Tuning	Daily: every 12 hours	Must meet method-specified abundance criteria.	Inspect system; correct problem; re-run standard and affected samples		
GC/MS SVOCs See SOM01.3	Initial calibration: 5 point standards	Upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration	RRF ≥ 0.05 (≥ 0.01 for poor responders); %RSD for all target compounds $\leq 20\%$ ($\leq 40\%$ for poor responders) or correlation coefficient > 0.995 if alternate curve is used.	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate.	Laboratory GC/MS Technician	SOM01.2

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
		acceptance criteria have not been met.				
	Continuing calibration (CCV)	Once every 12 hours; opening and closing CCVs must be run within same 12 hours	RRF ≥ 0.05 (≥ 0.01 for poor responders); %D $\leq 25\%$ ($\leq 40\%$ for poor responders).	Inspect system; correct problem; recalibrate the instrument, reanalyze samples and standards.		
	Calibration Standards Verification	Each lot of standards	As per lab established control limits	Inspect system; correct problem; re-run standard and affected samples		
	Tuning	Daily: every 12 hours	Must meet method-specified abundance criteria and tailing factor criteria.	Inspect system; correct problem; re-run standard and affected samples		
GC/ECD Pests See SOM01.3	Initial calibration	Upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met.	PEM resolution between two adjacent peaks $\geq 60.0\%$, single components $\geq 90.0\%$ resolved, RTs within the RT window (refer to SOM01.2), %Breakdown for DDT and endrin must be $\leq 20\%$; combined breakdown for DDR and endrin must be $\leq 30\%$. %RSD of CFs for each compound must be: $< 20\%$ for single component target	Inspect the system (e.g., change the column, bake out the detector, clean the injection port); correct problem, re-calibrate.	Laboratory GC/ECD Technician	SOM01.2

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			<p>compounds except alpha-BHC and delta-BHC; <25% for alpha-BHC and delta-BHC; <30% for toxaphene and surrogates.</p> <p>Peaks used for quantitation must be >10% and <100% of full scale.</p> <p>RTs within RT windows determined from ICAL (including surrogates).</p>			
	Instrument Blank and Continuing Calibration Verification	Once every 12 hours	<p>PEM resolution between two adjacent peaks $\geq 60.0\%$, single components $\geq 90.0\%$ resolved, RTs within the RT window (refer to SOM01.2) and %D for SCP compounds and surrogates must be $\geq -25\%$ and $\leq +25\%$,</p> <p>%Breakdown for DDT and endrin must be $\leq 20\%$; combined breakdown for DDR and endrin must be $\leq 30\%$.</p> <p>No target compound concentration > the CRQL and surrogate RTs</p>	Inspect system, recalibrate the instrument, and reanalyze samples.		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			<p>within RT windows determined from ICAL for instrument blank.</p> <p>%D for each compound CF must be $\geq -20\%$ and $\leq +20\%$.</p> <p>RTs within RT windows determined from ICAL (including surrogates).</p>			
GC/ECD PCBs See SOM01.3	Initial calibration	Upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met.	<p>%RSD of CFs for three to five peaks for each aroclor must be $<20\%$.</p> <p>Peaks used for quantitation must be $>50\%$ and $<100\%$ of full scale.</p> <p>RTs within RT windows determined from ICAL (including surrogates).</p>	Inspect the system (e.g., change the column, bake out the detector, clean the injection port); correct problem, re-calibrate.	Laboratory GC/ECD Technician	SOM01.2
	Instrument Blank and Continuing Calibration Verification	Once every 12 hours	<p>No target compound concentration $>$ the CRQL and surrogate RTs within RT windows determined from ICAL for instrument blank.</p> <p>%D for the CFs for each of the aroclor peaks used must be $\leq 15\%$ for beginning CCV and $\leq 50\%$ for ending CCV.</p>	Inspect system, recalibrate the instrument, and reanalyze samples.		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			RTs within RT windows determined from ICAL (including surrogates).			
GC/ECD Herbs See SOM01.3	Initial calibration	Upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met.	<p>Check standard surrogate recovery must be >50% and resolution must be >60%.</p> <p>%RSD of the CFs for three to five aroclor peaks must be ≤20%.</p> <p>RTs within RT windows determined from ICAL (including surrogates).</p>	Inspect the system (e.g., change the column, bake out the detector, clean the injection port); correct problem, re-calibrate.	Laboratory GC/ECD Technician	SOM01.2
	Instrument Blank and Continuing Calibration Verification	Once every 12 hours	<p>No target compound concentration > the CRQL and surrogate RTs within RT windows determined from ICAL for instrument blank.</p> <p>%D for the CFs for each of the compounds must be ≤25%.</p> <p>RTs within RT windows</p>	Inspect system, recalibrate the instrument, and reanalyze samples.		

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
			determined from ICAL (including surrogates).			

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-AES / ICP-MS	See ISM01.2; as per instrument manufacturer's recommended procedures	Initial calibration: daily or once every 24 hours and each time the instrument is set up.	ICP-AES: As per instrument manufacturer's recommended procedures, with at least 2 standards.	Inspect the system, correct problem, re-calibrate, and re-analyze samples.	Laboratory ICP-AES / ICP-MS Technician	ISM01.2
	Initial calibration	Daily; after tuning and optimizing instrument	Correlation coefficient >0.995 with a minimum of 3 standards and a blank	Repeat analysis; re-prepare calibration standards and reanalyze		
	ICV	Before sample analysis	90-110% recovery; source of standard separate from calibration standards	Re-calibrate instrument; prepare fresh ICV standards; do not analyze samples until problem is corrected		
	Reporting Limit Standard	After initial calibration verification standard	70-130% recovery	Re-analyze failed standard		
	CCV	Beginning and end of run; every 10 samples or every 2 hours during an analysis run, whichever is more frequent	90-110% recovery; source of standard separate from calibration standards	Re-check; re-calibrate and rerun all samples analyzed after last valid CCV		
CV-GAS	Calibration; 3 point standards	After instrument set up	$R^2 \geq 0.995$	Inspect system; correct problem	Laboratory analyst	TBD
	Initial Calibration Verification (ICV)	Before sample analysis	80-120% recovery; source of standard separate from calibration standards	Do not analyze samples until problem is corrected	Laboratory analyst	TBD

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Continuing Calibration Verification	10% or every 2 hours, whichever is more frequent	80-120% recovery	Inspect system, re-calibrate and rerun associated samples	Laboratory analyst	TBD
Colorimeter ⁴	Initial Calibration; 4 - 9 point standards	Every 3 months; every 6 months for method 300. or as per lab SOP	90-110 % recovery	Re-check; re-calibrate	Lab analyst / QA officer - TBD	SM01.2
	Calibration check (Cal Check)	Every 10 samples and at end of analytical run	80-120 % recovery	Re-check; re-calibrate and rerun all samples analyzed after last valid Cal Check	Lab analyst / QA officer - TBD	353.2
Infra red or UltraViolet Spectrophotometer	Initial Calibration; 5 point standards	Every 3 months or when other unresolved QC failure occurs	90-110 % recovery	Re-check; re-calibrate	Lab analyst / QA officer - TBD	TBD
	Calibration check	Every 10 samples and at end of analytical run	80-120 % recovery	Re-check; re-calibrate and rerun all samples analyzed after last valid cal check		
Thermometer	Calibration	Quarterly; serviced annually	See instrument manual	Replace defective thermometer	Lab analyst / QA officer - TBD	TBD
Balance	Calibration verification	Daily - before use	See instrument manual	Troubleshoot as per equipment manual/call for repair Troubleshoot as per equipment manual/call for repair	Lab analyst / QA officer - TBD Lab analyst / QA officer - TBD	TBD
	Mass check	Daily - before use	See instrument manual			
Thermometer	Temperature check	Annually	± 2°C	Replace defective thermometer	Lab analyst / QA officer - TBD	TBD
OvenpH meter	Serviced annually as per Manufacture's instructio	Lab analyst / QA officer - TBD	TBD	Recheck; replace buffer solutions and recheck. If still fails perform instrument	Lab analyst / QA officer - TBD	TBD

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Daily buffer checks (2 point bracketing sample pH)	Before use/per batch; other checks as per rental company and manufacturer's recommendations	± 0.1 pH units or ± 0.05 pH units	check or place out of service		

1. Arrowhead's Subcontractor's laboratory, Test America, calibration and/or method SOPs will be utilized to meet calibration criteria. Specific instrument information (Manufacturer and model) is not available at this time.
2. To be determined (TBD) - Reference SOP depends on the laboratory assignment.
3. R represents the correlation coefficient

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
For the Arrowhead's lower tier laboratory, the procured laboratory's SOPs and QA manual will detail these requirements. CDM will review and approve Arrowhead's Subcontractor's laboratory, Test America, SOPs and QA manual.								
Maintenance, testing and inspection frequencies are documented in the Test America SOPs.								
GC/MS	See TO-15; as per instrument manufacturer's recommendations	See TO-15; as per instrument manufacturer's recommendations		See TO-15; as per instrument manufacturer's recommendations	Acceptable re-calibration; see TO-15	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	GC/MS Technician	TO-15
GC/MS	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations		See SOM01.2; as per instrument manufacturer's recommendations	Acceptable re-calibration; see SOM01.2	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	GC/MS Technician	SOM01.2
GC/ECD	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations		See SOM01.2; as per instrument manufacturer's recommendations	Acceptable re-calibration; see SOM01.2	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	GC/ECD Technician	SOM01.2
ICP-AES / ICP-MS	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations; check connections		As per instrument manufacturer's recommendations	Acceptable re-calibration; see ISM01.2	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	ICP-AES / ICP-MS Technician	ISM01.2

Colorimeter	Daily	Clean glassware	Per Manufacturer's Instruction	Laboratory Staff	Manufacturer's Instruction
	Semi-annually	Physical inspection	Per Manufacturer's Instruction	Laboratory Staff	Manufacturer's Instruction

QAPP Worksheet #26
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT

Sample Collection: Arrowhead will collect all samples. Sample numbers will be assigned as described below. A coding system will be used to identify each sample collected during the duration of the project. This coding system will provide a tracking record to allow retrieval of information about a particular sample and ensure that each sample is uniquely identified. Each sample is identified by a unique code which indicates the sample type, sample number, and, in some cases, sample depth. A sample numbering system is described below which provides a unique identifier for all samples that will be collected during the site field investigation. The total number and types of samples collected are detailed in Worksheet #18. Forms 2 Lite will be used for tracking all samples collected during the project.

Qualified Arrowhead personnel will perform the sample packaging. Sample packaging will follow TSOP 1-2 and TSOP 2-1 (with modifications in Worksheet #21), with the exception that: sample tags and vermiculite will not be used. Please note that due to elevated temperatures during the summer, extra ice should be placed in the cooler to ensure that the temperature requirements are met.

Coordination of Shipment (Personnel/Organization): Arrowhead

Type of Shipment/Carrier: Priority Overnight Shipping/TBD. Samples for Saturday delivery will have the airbills checked for Saturday delivery.

Soil Sampling During Earthwork Construction Activities

Excess/Unsuitable Material Sampling

Soil samples collected will be designated "WC" for waste characterization, followed by a number (assigned sequentially) and then by the sample interval in inches. Arrowhead is responsible for documenting where the soil was collected.

Imported Granular Material Sampling

The soil samples collected will be designated as "CF" for common fill, "CS" for crushed stone, "STF" for structural fill, "SLF" for select fill and "TS" for topsoil, followed by a number (assigned sequentially) and then the date it was collected in the order of year/month/day (YYMMDD). Arrowhead is responsible for documenting where the soil was collected. For example, the first soil sample sample on collected on April 28, 2011 for the backfill soil will be named as FILL-1-110429.

ITP and O&M

Groundwater

The influent samples collected will be designated as "EW-1S", "EW-1I", "EW-1D", "SEW-1S", "SEW-1i", "SEW-1D" r "INF" where "INF" is the combined header representing the influent and then the date of collection in the order of yearrr/month/day (YYMMDD). For example, EW-1S-110905 represents a sample collected from the influent port of the treatment system on September 5, 2011.

QAPP Worksheet #26 Sample Handling System

The process samples collected after the EQ Tank during the ITP will be designated as "EQ" and then the date of collection in the order of year/month/day (YYMMDD). For example, EW-1S-110905 represents a sample collected from the influent port of the treatment system on September 5, 2011.

The effluent samples collected will be designated as "EFF" representing effluent, and then the date of collection in the order of year/month/day (YYMMDD). For example, EFF-110905 represents a sample collected from the effluent port of the treatment system on September 5, 2011.

The process samples collected after the air stripper (before the bag filter) will be designated as "AS" and then the date of collection in the order of year/month/day (YYMMDD). For example, AS-090605 represents a sample collected from a sample port after the air-stripper (before the bag filter) of the treatments system on 6/5/09.

Offgas

The air samples collected will be designated as "GAC1-INF" or "GAC1-EFF" or "GAC2-EFF" then the date of sample collection. For example, an influent air sample collected from GAC1 unit on January 3, 2010 will be designated as GAC1-INF-100103.

Sample Custody and Storage (Personnel/Organization): TBD

Sample Preparation (Personnel/Organization): TBD

Sample Determinative Analysis (Personnel/Organization): TBD

SAMPLE ARCHIVING

Field Sample Storage (No. of days from sample collection): All samples will be shipped to a CLP laboratory, DESA or a RA Subcontractor Laboratory on the day of collection via priority overnight (FedEx). Samples may be hand delivered/courier depending on laboratory location. On-site tests will be performed the same day.

Sample Extract/ Digestate Storage (No. of days from extraction/digestion): Refer to Worksheet #19 for holding time requirements

Biological Sample Storage (No. of days from sample collection): Not Applicable

SAMPLE DISPOSAL

Personnel/Organization: Laboratory responsible for analysis will dispose of samples

Number of Days from Analysis: 90 days

QAPP Worksheet #27
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Packaging will be performed according to TSOP 2-1 (with modifications in Worksheet #21). To maintain a record of sample collection transfer between field personnel, shipment, and receipt by the laboratory, the applicable sample chain-of-custody paperwork (TSOP 1-2) is completed for each shipment (i.e., cooler) of packed sample bottles or summa cannisters. The team member actually performing the sampling is personally responsible for the care and custody of the samples collected until they are transferred properly. Arrowhead will review all field sampling activities to confirm that proper custody procedures were followed during the field work. Arrowhead personnel relinquishing the sample to the courier will sign the chain of custody record.

All courier receipts and/or paperwork associated with the shipment of samples will serve as a custody record for the samples while they are in transit from the field to the laboratory. Custody seals should remain intact during this transfer.

Coolers are secured with nylon fiber tape and at least two custody seals are placed across cooler openings. Since custody forms are sealed inside the sample cooler and custody seals remain intact, commercial carriers are not required to sign the chain-of-custody form. Examples of custody seals are included in TSOP 1-2. For summa cannister shipments, the summa cannister will be shipped in a box secured with nylon fiber tape and at least two custody seals placed across the box openings. No custody seals are required on the summa cannister itself. Examples of custody seals are included in TSOP 1-2.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

A sample custodian at the laboratory will accept custody of shipped samples, and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory manager for corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. Disposal of the samples will occur only after analyses and QA/QC checks are completed. This will complete sample transfer.

It will be each laboratory's responsibility to maintain internal logbooks and records that provide a custody record throughout sample preparation and analysis. To track field samples through data handling, Arrowhead will maintain photocopies of all chain-of-custody forms.

Sample Identification Procedures:

Refer to Worksheet #26.

Chain-of-custody Procedures:

The subcontractor responsible for sampling and will follow TSOP 1-2, Sample Custody, for chain-of-custody procedures.

QAPP Worksheet #28
QC Samples Table

Duplicates: Field duplicate samples are collected and analyzed to assess the overall precision of the field sampling technique. Duplicate samples, of a similar matrix, will be collected at a rate of five percent or at least one per every 20 samples. These duplicates will be submitted "blind" to the laboratories by using sample numbers that differ from their associated environmental samples. See Worksheet #20 for duplicate quantities. Duplicate samples will be co-located.

Trip Blanks An aqueous trip blank will be prepared the laboratory for analysis of VOCs. Trip blanks are used to determine whether on site atmospheric contaminants are seeping into the sample vials, or if any cross-contamination of samples is occurring during shipment or storage of sample containers. A trip blank consists of demonstrated analyte-free water sealed in 40-ml Teflon septum vials with no headspace (including bubbles) in the vials. Trip blank water will be considered analyte-free when analysis results for VOC analysis are below CRQL. Certification of blank water quality will be kept on site and will be filed in the project files once field work is completed. A sample of the blank water lot used in the field will be submitted for confirmatory analysis.

Trip blanks are to be kept in close proximity to the samples being collected and will be maintained at 4 degrees Celsius (°C) and handled in the same manner as the other VOC samples. Preservation of trip blanks is presented on Worksheet # 19. One trip blank will be included with each daily shipment that contains aqueous samples collected for VOC analysis. Trip blanks will be analyzed by the same VOC method as the associated set of samples.

Field Blanks: One field blank will be collected for each equipment type per decontamination event and will be analyzed for the same constituents as the environmental samples. Field blanks, also known as "rinse blanks" or "equipment blanks," are used to assess the effectiveness of equipment decontamination. Field blanks will be collected before the use of the decontaminated equipment for sampling. The frequency for field blanks is one per decontamination event, not to exceed one per day, for each equipment type and for each sample matrix. Field blanks are generated by pouring demonstrated analyte-free water over or through the decontaminated sampling tool. The definition of demonstrated analyte-free water is discussed in the previous section.

Field blanks will be collected in a way that will minimize potential contamination from the ambient air. The use of the same aliquot of water on all equipment associated with a particular matrix for the required analyses is permissible. However, a separate field rinse blank must be collected for each piece of equipment associated with a particular sample matrix that will be analyzed for the analyses listed in Worksheet #20. Preservation of field blanks is specified on Worksheet # 19. Field blanks will accompany the set of samples collected by the decontaminated sampling equipment and will be kept at 4°C. *On a project-specific basis field blanks may be minimized by decreasing the frequency of decontamination and using additional equipment. In this case the samples associated with the field blank will be noted in the field logbooks and sample trip report.*

QAPP Worksheet #28
QC Samples Table

Cooler Temperature Indicators

One cooler temperature indicator or “temperature blank” will be placed in each cooler containing samples (solid and aqueous, except for grain size analysis) being sent to the laboratory for analysis. The temperature blank will consist of a sample container filled with non-preserved water (potable or distilled). The container will be labeled “COOLER TEMPERATURE INDICATOR” and dated.

Matrix Spikes (see Worksheet #20 for the parameters requiring Matrix Spikes)

Matrix spikes (MS) are laboratory QC samples drawn from excess volumes of existing samples to demonstrate the accuracy of laboratory analysis. In accordance with EPA Region 2, matrix spikes will be designated on environmental samples at a rate of one per sample delivery group (SDG). This designation will be noted on the sample container labels and the sample paperwork. An SDG is defined as one of the following:

1. All samples of an analytical case if the sample number is less than 20 (including environmental duplicates and QC blanks) and if sampling is completed within 7 calendar days.
2. Each group of 20 samples within an analytical case (including environmental duplicates, but excluding QC blanks) if the number is greater than 20.
3. Each 7-day calendar day period during which samples within an analytical case are received. This period begins with the receipt of the first sample in the SDG.

Triple volume may be required for aqueous VOC matrix MS/MSD if a subcontract laboratory is being used and are not required for CLP method SOM01.3. The water quality parameters do not require extra volume unless identified on Worksheet #19 and confirmed with a non-CLP laboratory.

QAPP Worksheet #28a
QC Samples Table

Matrix	Air					
Analytical Group	VOCs					
Concentration Level	Low (ppbv)					
Sampling SOP(s)	See Worksheet #21					
Analytical Method/SOP Reference	TO-15					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See Worksheet #20					
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify SM/ RA Subcontractor and flag field duplicate results	Laboratory Technician	Precision	±25 % RPD
Laboratory Method Blank	1 per 20 samples	No analyte >CRQL	Suspend analysis unit source recertified	Laboratory Technician	Accuracy	No analyte > CRQL
Laboratory Replicate Sample	1 per 20 samples	± 25%D	± 25%D	Laboratory Technician	Precision	± 25%RPD
Laboratory Control Sample	1 per 20 samples	±30% R	Flag outliers	Laboratory Technician	Accuracy	70-130% R

QAPP Worksheet #28bi
QC Samples Table

Matrix	Soil							
Analytical Group	TCL VOCs i							
Concentration Level	Low (µg/kg)							
Sampling SOP(s)	See Worksheet #21							
Analytical Method/SOP Reference	SOM01.2							
Sampler's Name	TBD							
Field Sampling Organization	Arrowhead							
Analytical Organization	As per Worksheet #30							
No. of Sample Locations	See Worksheet #20							
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Field Duplicate	1 per 20 samples	None		Notify SM/ RA Subcontractor and flag duplicate results	Arrowhead Personnel	Precision	100% RPD ABS ≤ 5xCRQL	
Temperature Blank	1 per cooler	≤ 6 degrees Celsius		Increase coolant	Arrowhead Personnel	Accuracy	≤ 10 degrees Celsius	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Arrowhead Personnel	Accuracy / Contamination	No analyte > CRQL*	
Method Blank	1 every 12 hours	No analyte > CRQL*		Suspend analysis unit source recertified	Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*	
Matrix Spike (Not Required)	1 per ≤ 20 samples; if requested	1,1-Dichloroethene	59-172 %R	Flag outliers	Laboratory GC/MS Technician	Accuracy	1,1-Dichloroethene	59-172 %R
		Trichloroethene	62-137 %R				Trichloroethene	62-137 %R
		Benzene	66-142 %R				Benzene	66-142 %R
		Toluene	59-139 %R				Toluene	59-139 %R
		Chlorobenzene	60-133 %R				Chlorobenzene	60-133 %R

Matrix Spike Duplicate (Not Required)	1 per ≤ 20 samples; if requested	1,1-Dichloroethene	0-22 %RPD	Flag outliers	Laboratory GC/MS Technician	Precision	1,1-Dichloroethene	0-22 %RPD
		Trichloroethene	0-24 %RPD				Trichloroethene	0-24 %RPD
		Benzene	0-21 %RPD				Benzene	0-21 %RPD
		Toluene	0-21 %RPD				Toluene	0-21 %RPD
		Chlorobenzene	0-21 %RPD				Chlorobenzene	0-21 %RPD

*with the exception of methylene chloride, 2-butanone & acetone which can be up to 2 times the CRQL. (EPA CLP National Functional Guidelines, Final, July 2007)

Matrix	Soil
Analytical Group	TCL VOCs [cont'd]
Concentration Level	Low (µg/kg)
Sampling SOP(s)	See Worksheet #21
Analytical Method/SOP Reference	SOM01.2
Sampler's Name	TBD
Field Sampling Organization	Arrowhead
Analytical Organization	As per Worksheet #30
No. of Sample Locations	See Worksheet #20

QAPP Worksheet #28bii
QC Samples Table

Old Roosevelt Field Superfund Site
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QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Deuterated Monitoring Compounds	all samples	Vinyl chloride-d3	68-122 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet necessary limits (Section 11.3.4, Page D45 of SOM01.2)	Laboratory GC/MS Technician	Accuracy	Vinyl chloride-d3	68-122 %R
		Chloroethane-d5	61-130 %R				Chloroethane-d5	61-130 %R
		1,1-Dichloroethene-d2	45-132 %R				1,1-Dichloroethene-d2	45-132 %R
		2-Butanone-d5	20-182 %R				2-Butanone-d5	20-182 %R
		Chloroform-d	72-123 %R				Chloroform-d	72-123 %R
		1,2-Dichloroethane-d4	79-122 %R				1,2-Dichloroethane-d4	79-122 %R
		Benzene-d6	80-121 %R				Benzene-d6	80-121 %R
		1,2-Dichloropropane-d6	74-124 %R				1,2-Dichloropropane-d6	74-124 %R
		Toluene-d8	78-121 %R				Toluene-d8	78-121 %R
		trans-1,3-Dichloropropene-d4	72-130 %R				trans-1,3-Dichloropropene-d4	72-130 %R
		2-Hexanone-d5	17-184 %R				2-Hexanone-d5	17-184 %R
		1,4-Dioxane-d8	50-150 %R				1,4-Dioxane-d8	50-150 %R
		1,1,2,2-Tetrachloroethane-d2	56-161 %R				1,1,2,2-Tetrachloroethane-d2	56-161 %R
		1,2-Dichlorobenzene-d4	70-131 %R				1,2-Dichlorobenzene-d4	70-131 %R
Internal Standards	all samples	50-200% of area, ± 30 second retention time shift		Check calculations/ instruments reanalyze affected samples	Laboratory GC/MS Technician	Accuracy	50-100% of area, ± 30 second retention time shift	

QAPP Worksheet #28c
QC Samples Table

Matrix	Soil
Analytical Group	TCL SVOCs including aniline
Concentration Level	Low (µg/kg)
Sampling SOP(s)	See Worksheet #21
Analytical Method/SOP Reference	SOM01.2 Modified
Sampler's Name	TBD
Field Sampling Organization	Arrowhead
Analytical Organization	As per Worksheet #30
No. of Sample Locations	See Worksheet #20

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Correctiv e Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤ 5xCRQL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL*

Method Blank	1 per 20 samples or batch	No analyte > CRQL*		Suspend analysis unit source recertified	Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*	
Matrix Spike (Not Required)	1 per 20 samples; if requested	Phenol	26-90 %R	Flag outliers	Laboratory GC/MS Technician	Accuracy	Phenol	26-90 %R
		2-Chlorophenol	25-102 %R				2-Chlorophenol	25-102 %R
		N-Nitroso-di-n-propylamine	41-126 %R				N-Nitroso-di-n-propylamine	41-126 %R
		4-Chloro-3-methylphenol	26-103 %R				4-Chloro-3-methylphenol	26-103 %R
		Acenaphthene	31-137 %R				Acenaphthene	31-137 %R
		4-Nitrophenol	11-114 %R				4-Nitrophenol	11-114 %R
		2,4-Dinitrotoluene	28-89 %R				2,4-Dinitrotoluene	28-89 %R
		Pentachlorophenol	17-109 %R				Pentachlorophenol	17-109 %R
		Pyrene	35-142 %R				Pyrene	35-142 %R

*with the exception of bis (2-Ethylhexyl) phthalate which can be up to 5 times the CRQL. (EPA CLP National Functional Guidelines, Final, July 2007)

QAPP Worksheet #28c
QC Samples Table

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
TCL SVOCs – Soil Continued								
Matrix Spike Duplicate (Not Required)	1 per 20 samples; if requested	Phenol	0-35 %RPD	Flag outliers	Laboratory GC/MS Technician	Precision	Phenol	0-35 %RPD
		2-Chlorophenol	0-50 %RPD				2-Chlorophenol	0-50 %RPD
		N-Nitroso-di-n-propylamine	0-38 %RPD				N-Nitroso-di-n-propylamine	0-38 %RPD
		4-Chloro-3-methylphenol	0-33 %RPD				4-Chloro-3-methylphenol	0-33 %RPD
		Acenaphthene	0-19 %RPD				Acenaphthene	0-19 %RPD
		4-Nitrophenol	0-50 %RPD				4-Nitrophenol	0-50 %RPD
		2,4-Dinitrotoluene	0-47 %RPD				2,4-Dinitrotoluene	0-47 %RPD
		Pentachlorophenol	0-47 %RPD				Pentachlorophenol	0-47 %RPD
		Pyrene	0-36 %RPD				Pyrene	0-36 %RPD
Deuterated Monitoring Compound s	all samples	Phenol-d5	17-103 %R	Check calculations and instruments, reanalyze affected samples; up to 4 DMCs may fail to meet recovery limits (Section 11.3.4, Page D48/SVOC of SOM01.2)	Laboratory GC/MS Technician	Accuracy	Phenol-d5	17-103 %R
		Bis(2-chloroethyl)ether-d8	12-98 %R				Bis(2-chloroethyl)ether-d8	12-98 %R
		2-Chlorophenol-d4	13-101 %R				2-Chlorophenol-d4	13-101 %R
		4-Methylphenol-d8	8-100 %R				4-Methylphenol-d8	8-100 %R
		Nitrobenzene-d5	16-103 %R				Nitrobenzene-d5	16-103 %R
		2-Nitrophenol-d4	16-104 %R				2-Nitrophenol-d4	16-104 %R
		2,4-Dichlorophenol-d3	23-104 %R				2,4-Dichlorophenol-d3	23-104 %R
		4-Chloroaniline-d4	1-145 %R				4-Chloroaniline-d4	1-145 %R
		Dimethylphthalate-d6	43-111 %R				Dimethylphthalate-d6	43-111 %R

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
		Acenaphthylene-d8	20-97 %R				Acenaphthylene-d8	20-97 %R
		4-Nitrophenol-d4	16-166 %R				4-Nitrophenol-d4	16-166 %R
		Fluorene-d10	40-108 %R				Fluorene-d10	40-108 %R
		4,6-Dinitro-2-methylphenol-d2	1-121 %R				4,6-Dinitro-2-methylphenol-d2	1-121 %R
		Anthracene-d10	22-98 %R				Anthracene-d10	22-98 %R
		Pyrene-d10	51-120 %R				Pyrene-d10	51-120 %R
		Benzo(a)pyrene-d12	43-111 %R				Benzo(a)pyrene-d12	43-111 %R
Internal Standards	all samples	50-200% of area, ± 30 second retention time shift		Check calculations and instruments, reanalyze affected samples	Laboratory GC/MS Technician	Accuracy	50-200% of area, ± 30 second retention time shift	

QAPP Worksheet #28d
QC Samples Table

Matrix	Soil							
Analytical Group	TCL Pesticides including parathion							
Concentration Level	Low (µg/kg)							
Sampling SOP(s)	See Worksheet #21							
Analytical Method/SOP Reference	SOM01.2 Modified							
Sampler's Name	TBD							
Field Sampling Organization	Arrowhead							
Analytical Organization	As per Worksheet #30							
No. of Sample Locations	See Worksheet #20							
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Field Duplicate	1 per 20 samples	None		Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤ 5xCRQL	
Temperature Blank	1 per cooler	≤ 6 degrees Celsius		Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL	
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL	
Matrix Spike	1 per 20 samples	gamma-BHC (Lindane)	46-127 %R	Flag outliers	Laboratory GC/ECD Technician	Accuracy	gamma-BHC (Lindane)	46-127 %R
		Heptachlor	35-130 %R				Heptachlor	35-130 %R

		Aldrin	34-132 %R				Aldrin	34-132 %R
		Dieldrin	31-134 %R				Dieldrin	31-134 %R
		Endrin	42-139 %R				Endrin	42-139 %R
		4,4-DDT	23-134 %R				4,4-DDT	23-134 %R
Matrix Spike Duplicate	1 per 20 samples	gamma- BHC	0-50 %RPD	Flag outliers	Laboratory GC/ECD Technician	Precision	gamma- BHC	0-50 %RPD
		Heptachlor	0-31 %RPD				Heptachlor	0-31 %RPD
		Aldrin	0-43 %RPD				Aldrin	0-43 %RPD
		Dieldrin	0-38 %RPD				Dieldrin	0-38 %RPD
		Endrin	0-45 %RPD				Endrin	0-45 %RPD
		4,4-DDT	0-50 %RPD				4,4-DDT	0-50 %RPD

QAPP Worksheet #28d
QC Samples Table

Matrix	Soil							
Analytical Group	TCL Pesticides [cont'd]							
Concentration Level	Low (µg/kg)							
Sampling SOP(s)	See Worksheet #21							
Analytical Method/SOP Reference	SOM01.2							
Sampler's Name	TBD							
Field Sampling Organization	Arrowhead							
Analytical Organization	As per Worksheet #30							
No. of Sample Locations	See Worksheet #20							
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Laboratory Control Sample	all samples	gamma-BHC	50-120 %R	Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	gamma-BHC	50-120 %R
		Heptachlor epoxide	50-150 %R				Heptachlor epoxide	50-150 %R
		Dieldrin	30-130 %R				Dieldrin	30-130 %R
		4,4'-DDE	50-150 %R				4,4'-DDE	50-150 %R
		Endrin	50-120 %R				Endrin	50-120 %R
		Endosulfan sulfate	50-120 %R				Endosulfan sulfate	50-120 %R
		gamma-Chlordane	30-130 %R				gamma-Chlordane	30-130 %R
Surrogate	all samples	30-150 %R		Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	30-150 %R	

*Parathion's MPC will be defined by EPA.

QAPP Worksheet #28e
QC Samples Table

Matrix		Soil						
Analytical Group		TCL PCBs						
Concentration Level		Low (µg/kg)						
Sampling SOP(s)		See Worksheet #21						
Analytical Method/SOP Reference		SOM01.2						
Sampler's Name		TBD						
Field Sampling Organization		Arrowhead						
Analytical Organization		As per Worksheet #30						
No. of Sample Locations		See Worksheet #20						
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Field Duplicate	1 per 20 samples	None		Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤5xCRQL	
Temperature Blank	1 per cooler	≤ 6 degrees Celsius		Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL	
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL	
Matrix Spike	1 per 20 samples	Aroclor-1016	29-135 %R	Flag outliers	Laboratory GC/ECD Technician	Accuracy	Aroclor-1016	29-135 %R
		Aroclor-1260	29-135 %R				Aroclor-1260	29-135 %R

Matrix Spike Duplicate	1 per 20 samples	Aroclor-1016	0-15 %RPD	Flag outliers	Laboratory GC/ECD Technician	Precision	Aroclor-1016	0-15 %RPD
		Aroclor-1260	0-20 %RPD				Aroclor-1260	0-20 %RPD
Laboratory Control Sample	all samples	Aroclor-1016	50-150 %R	Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	Aroclor-1016	50-150 %R
		Aroclor-1260	50-150 %R				Aroclor-1260	50-150 %R
Surrogate	all samples	30-150%R		Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	30-150%R	

QAPP Worksheet #28f
QC Samples Table

Matrix	Soil					
Analytical Group	TAL – Metals					
Concentration Level	Low (µg/kg)					
Sampling SOP(s)	See Worksheet #21					
Analytical Method/SOP Reference	ISM01.2					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See Worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No constituent > CRQL
Preparation Blank	1 per 20 samples	No constituent > CRQL	Suspend analysis until source rectified; re-digest and reanalyze affected samples	Laboratory ICP-AES/ICP-MS Technician	Accuracy	No constituent > CRQL
Matrix Spike	1 per 20 samples	75-125%R*	Flag outliers		Accuracy	75-125%R*
Laboratory Duplicate	1 per 20 samples	± 35% RPD**	Flag outliers		Precision	± 35% RPD**
Post-Digestion Spike	after any analyte (except Ag and Hg) fails spike %R	75-125%R	Flag outliers		Accuracy	75-125%R

Interference Check Sample [ICP Analysis Only]	beginning, end and periodically during run (2 times every 8 hours)	Within ± 2 times CRQL of true value or $\pm 20\%$ of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples		Sensitivity	Within ± 2 times CRQL of true value or $\pm 20\%$ of true value, whichever is greater
Laboratory Control Sample	1 per 20 samples	Control limits established by EPA*	Suspend analysis rectify source; re-digest and reanalyze affected samples		Accuracy	Control limits established by EPA* or 70-130% recovery

*except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken

**Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

**except when the sample and/or duplicate concentration is less than 5 times the CRQL.

* If the EPA LCS is unavailable, other EPA QC samples or other certified materials may be used. In such cases, control limits for the LCS must be documented and provided.

QAPP Worksheet #28g
QC Samples Table

Matrix	Soil					
Analytical Group	TAL –Total Mercury					
Concentration Level	Low (µg/kg)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	SOM01.2 – Cold Vapor Atomic Absorption (CVAA)					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify SM/ RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤ 5xCRQL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re- analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Preparation Blank (PB)	1 per 20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	Laboratory Technician	Accuracy	No analyte > CRQL
Laboratory Duplicate	1 per 20 samples	± 35% RPD	Flag outliers	Laboratory Technician	Precision	± 35% RPD
Spike Sample	1 per 20 samples	75 – 125 %R	Flag outliers	Laboratory Technician	Accuracy	75 – 125 %R

Laboratory Control Sample	120 samples	Control limits established by EPA*	Flag outliers	Laboratory Technician	Accuracy	Control limits established by EPA*
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* If the EPA LCS is unavailable, other EPA QC samples or other certified materials may be used. In such cases, control limits for the LCS must be documented and provided.

QAPP Worksheet #28h
QC Samples Table

Matrix		Soil				
Analytical Group		Herbicide (2,4,5-T, silvex, and 2,4-D)				
Concentration Level		Low (µg/kg)				
Sampling SOP(s)		See Worksheet #21				
Analytical Method/SOP Reference		SOM01.2				
Sampler's Name		TBD				
Field Sampling Organization		Arrowhead				
Analytical Organization		As per Worksheet #30				
No. of Sample Locations		See Worksheet #20				
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	100% RPD ABS ≤ 5xCRQL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL	Suspend analysis unit source recertified	Laboratory GC/ECD Technician	Accuracy	No analyte > CRQL
Matrix Spike	1 per 20 samples	65 – 135 % R	Flag outliers	Laboratory GC/ECD Technician	Accuracy	65 – 135 % R
Matrix Spike Duplicate	1 per 20 samples	65 – 135 % R	Flag outliers	Laboratory GC/ECD Technician	Precision	65 – 135 % R

Laboratory Control Sample	all samples	80 – 120 % R	Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	80 – 120 % R
Surrogate	all samples	30-150%R	Check calculations and instruments, reanalyze affected samples	Laboratory GC/ECD Technician	Accuracy	30-150%R

QAPP Worksheet #28i
QC Samples Table

Matrix	Soil					
Analytical Group	Grain Size					
Concentration Level	Low/Medium (percent particle sizes)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	ASTM D421-85 and ASTM D422-63					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (Project-specific)
Per ASTM Method	Per ASTM Method	Per ASTM Method	Per ASTM Method	laboratory analyst	Per ASTM Method	Per ASTM Method

Notes:

1. The laboratory will be required to ensure that QC is performed in accordance with the ASTM method.
2. The data obtained will be compared to publish data and to other data obtained from the site (i.e., lithologic logs) by the geotechnical engineer/hydrogeologist and any Abnormalities will be flagged.
3. The data will not be validated.

QAPP Worksheet #28j
QC Samples Table

Matrix		Groundwater						
Analytical Group		TCL VOCs						
Concentration Level		Trace (µg/L)						
Sampling SOP(s)		See Worksheet #21						
Analytical Method/SOP Reference		SOM01.2						
Sampler's Name		TBD						
Field Sampling Organization		Arrowhead						
Analytical Organization		As per Worksheet #30						
No. of Sample Locations		See Worksheet #20						
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Field Duplicate	1 per 20 samples	None		Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	25 % RPD ABS ≤ 5xCRQL	
Temperature Blank	1 per cooler	≤ 6 degrees Celsius		Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius	
Trip Blank	1 per cooler	≤ CRQL		Verify results; re-analyze. Flag outliers	Laboratory analyst	Accuracy / Contamination	No analyte > CRQL	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL	
Method Blank	1 every 12 hours	No analyte > CRQL*		Suspend analysis unit source recertified	Laboratory GC/MS Technician	Accuracy	No analyte > CRQL*	
Matrix Spike (Not	1 per 20 samples; if	1,1-Dichloroethene	61-145 %R	Flag outliers		Accuracy	1,1-Dichloroethene	61-145 %R

Required)	requested	Benzene	76-127 %R				Benzene	76-127 %R
		Trichloroethene	71-120 %R				Trichloroethene	71-120 %R
		Toluene	76-125 %R				Toluene	76-125 %R
		Chlorobenzene	75-130 %R				Chlorobenzene	75-130 %R
Matrix Spike Duplicate (Not Required)	1 per 20 samples; if requested	1,1- Dichloroethene	0-14 %RPD	Flag outliers		Precision	1,1- Dichloroethene	0-14 %RPD
		Benzene	0-11 %RPD				Benzene	0-11 %RPD
		Trichloroethene	0-14 %RPD				Trichloroethene	0-14 %RPD
		Toluene	0-13 %RPD				Toluene	0-13 %RPD
		Chlorobenzene	0-13 %RPD				Chlorobenzene	0-13 %RPD

Deuterated Monitoring Compounds	all samples	Vinyl chloride-d3	65-131 %R	Check calculations and instruments, reanalyze affected samples		Accuracy	Vinyl chloride-d3	65-131 %R
		Chloroethane-d5	71-131 %R				Chloroethane-d5	71-131 %R

*with the exception of methylene chloride, 2-butanone and acetone which can be up to 2 times the CRQL, or in some situations may require these compounds be up to 4 times the CRQL.

QAPP Worksheet #28k
QC Samples Table

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
TCL VOCs Continued								
Deuterated Monitoring Compounds [cont'd]	all samples	1,1-Dichloroethene-d2	55-104 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet recovery limits	Laboratory GC/MS Technician	Accuracy	1,1-Dichloroethene-d2	55-104 %R
		2-Butanone-d5	49-155 %R				2-Butanone-d5	49-155 %R
		Chloroform-d	78-121 %R				Chloroform-d	78-121 %R
		1,2-Dichloroethane-d4	78-129 %R				1,2-Dichloroethane-d4	78-129 %R
		Benzene-d6	77-124 %R				Benzene-d6	77-124 %R
		1,2-Dichloropropane-d6	79-124 %R				1,2-Dichloropropane-d6	79-124 %R
		Toluene-d8	77-121 %R				Toluene-d8	77-121 %R
		trans-1,3-Dichloropropene-d4	73-121 %R				trans-1,3-Dichloropropene-d4	73-121 %R
		2-Hexanone-d5	28-135 %R				2-Hexanone-d5	28-135 %R
		1,4-Dioxane-d8	50-150 %R				1,4-Dioxane-d8	50-150 %R
		1,1,2,2-Tetrachloroethane-d2	73-125 %R				1,1,2,2-Tetrachloroethane-d2	73-125 %R
		1,2-Dichlorobenzene-d4	80-131 %R				1,2-Dichlorobenzene-d4	80-131 %R
Internal Standards	all samples	60-140%		Check calculations and instruments, reanalyze affected samples		Accuracy	± 40 % of response area, ± 20 sec retention time shift	

QAPP Worksheet #28I
QC Samples Table

Matrix	Groundwater					
Analytical Group	TAL inorganic Metals					
Concentration Level	Low (µg/L)					
Sampling SOP(s)	See Worksheet #21					
Analytical Method/SOP Reference	ISM01.2					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See Worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	≤20% RPD ABS ≤ 5xCRQL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No constituent > CRQL
Preparation Blank	1 per 20 samples	No constituent > CRQL	Suspend analysis rectify source; redigest and reanalyze affected samples	Laboratory ICP Technician	Accuracy	No constituent > CRQL
Spike	1 per 20 samples	75-125%R*	Flag outliers	Laboratory ICP Technician	Accuracy	75-125%R*
Laboratory Duplicate	1 per 20 samples	± 20% RPD**	Flag outliers	Laboratory ICP Technician	Precision	± 20% RPD**

Post-Digestion Spike	after any analyte (except Ag and Hg) fails spike %R	75-125%R	Flag outliers	Laboratory ICP Technician	Accuracy	75-125%R
Interference Check Sample [ICP Analysis Only]	beginning, end and periodically (not less than 1 per 20 samples)	$\pm 2 \times$ CRQL of true value or $\pm 20\%$ of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples	Laboratory ICP Technician	Sensitivity	± 2 times CRQL of true value or $\pm 20\%$ of true value, whichever is greater
Laboratory Control Sample	1 per 20 samples	80-120%R (except Ag and Sb)	Suspend analysis until source rectified; redigest and reanalyze affected samples	Laboratory ICP Technician	Accuracy	80-120%R (except Ag and Sb)

*except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken

**Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

**except when the sample and/or duplicate concentration is less than 5 times the CRQL, then \pm CRQL.

QAPP Worksheet #28m
QC Samples Table

Matrix	Groundwater
Analytical Group	TAL – Total Mercury
Concentration Level	Low (µg/L)
Sampling SOP(s)	See worksheet #21
Analytical Method/SOP Reference	ISM01.3 – Cold Vapor Atomic Absorption (CVAA)
Sampler's Name	TBD
Field Sampling Organization	Arrowhead
Analytical Organization	As per Worksheet #30
No. of Sample Locations	See worksheet #20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	≤20% RPD
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re- analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Preparation Blank (PB)	1 per 20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	Laboratory Technician	Accuracy	No analyte > CRQL
Laboratory Duplicate	1 per 20 samples	± 20% RPD*	Flag outliers	Laboratory Technician	Precision	≤ 20% RPD
Spike Sample	1 per 20 samples	75 – 125 %R	Flag outliers	Laboratory Technician	Accuracy	75 – 125 %R
Laboratory Control Sample	1 per 20 samples	80-120%R	Suspend analysis until source rectified; redigest and reanalyze affected samples	Laboratory Technician	Accuracy	80-120%R

*Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

Old Roosevelt Field Superfund Site RA QAPP

QAPP Worksheet #28n
QC Samples Table

Matrix	Groundwater					
Analytical Group	TAL – Total Cyanide					
Concentration Level	Low (µg/L)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	ISM01.3					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	None	Notify RA Subcontractor and flag duplicate results	RA Subcontractor Personnel	Precision	≤20% RPD
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re- analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy / Contamination	No analyte > CRQL
Preparation Blank (PB)	1 per 20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	Laboratory Technician	Accuracy	No analyte > CRQL
Laboratory Duplicate	1 per 20 samples	± 20% RPD*	Flag outliers	Laboratory Technician	Precision	≤ 20% RPD
Spike Sample	1 per 20 samples	75 – 125 %R	Flag outliers	Laboratory Technician	Accuracy	75 – 125 %R
Laboratory Control Sample	1 per 20 samples	85-115%R	Suspend analysis until source rectified; redigest and reanalyze affected samples	Laboratory Technician	Accuracy	85-115%R

*Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include absolute difference criteria)

QAPP Worksheet #28o
QC Samples Table

Matrix	Groundwater					
Analytical Group	Nitrate/Nitrite					
Concentration Level	Low (mg/L)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	353.2					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per Worksheet #30					
No. of Sample Locations	See worksheet #20					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Blank (FB)	1 per decontamination event not to exceed 1 per day	None	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy/Sensitivity	No analyte > QL
Temperature Blank	1 per cooler	≤ 6 degrees Celsius	Increase coolant	RA Subcontractor Personnel	Accuracy	≤ 10 degrees Celsius
Field Duplicate	1 per 20 samples	None	Data assessor to inform RA Subcontractor Personnel if MPC is exceeded; flag duplicate results	RA Subcontractor Personnel	Precision	≤ 25% RPD ABS ≤ 5xCRQL
Preparation Blank (PB)	1 per 20 samples	None	Suspend analysis; check; redigest and reanalyze	Laboratory Analyst	Accuracy/Sensitivity	No analyte > QL

Laboratory Duplicate	1 per 20 samples	None	Flag outliers	Laboratory Analyst	Precision	≤ 20% RPD
Spike Samples	1 per 20 samples	90-110%	Flag outliers	Laboratory Analyst	Accuracy	75-125%R
Laboratory Control Sample	After calibration, every 20 samples and at end of day	90-110%	Identify source of problem, correct and reanalyze	Laboratory Analyst	Accuracy	90-110%R

Control limits for the LCS must be documented and provided.

QAPP Worksheet #28p
QC Samples Table

Matrix	Groundwater					
Analytical Group	Oil and Grease					
Concentration Level	Low (mg/L)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	1664a					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	Field Analysis					
No. of Sample Locations	See worksheet #20					
Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Blank	1 per decontamination event not to exceed 1 per day	No analyte > QL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy/Sensitivity	No analyte > QL
Field Duplicate	1 per 20 samples	None	Reanalyze. Re-perform calibration check if still outlying.	Field analyst	Precision	≤ 20% RPD
Preparation Blank	Daily or 1 per 20 samples	No analyte > QL	Suspend analysis; re-prep and reanalyze	Field analyst	Accuracy/Sensitivity	No analyte > QL
Matrix Spike	1 per 20 samples	78-114%	Identify source of problem, correct and reanalyze	Laboratory Analyst	Accuracy	78-114%R

Laboratory Duplicate	Daily or 1 per 20 samples	18% RPD	Reanalyze. Re-perform calibration check if still outlying.	Laboratory Analyst	Precision	≤ 20% RPD
Initial Precision and Recovery	Once at method startup and anytime method is changed	83-101% RPD≤11	Reanalyze. Re-perform calibration check if still outlying.	Laboratory Analyst	Accuracy and Precision	83-101% RPD≤11
LCS (ongoing precision and recovery)	Daily or 1 per 20 samples	78-114%	Identify source of problem, correct and reanalyze	Laboratory Analyst	Accuracy	78-114%R

Control limits for the LCS based on SW846 Method 1664a Table 1 criteria..

QAPP Worksheet #28q
QC Samples Table

Matrix	Groundwater					
Analytical Group	TSD and TSS					
Concentration Level	Low (mg/L)					
Sampling SOP(s)	See worksheet #21					
Analytical Method/SOP Reference	SM 2540C and SM 2540D					
Sampler's Name	TBD					
Field Sampling Organization	Arrowhead					
Analytical Organization	As per worksheet 30					
No. of Sample Locations	See worksheet #20					
Lab QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Blank	1 per decontamination event not to exceed 1 per day	No analyte > QL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / RA Subcontractor	Accuracy/Sensitivity	No analyte > QL
Field Duplicate	1 per 20 samples	None	Reanalyze. Re-perform calibration check if still outlying.	Field analyst	Precision	≤ 25% RPD
Preparation Blank	Daily or 1 per 20 samples	No analyte > QL	Suspend analysis; re-prep and reanalyze	Laboratory Analyst	Accuracy/Sensitivity	No analyte > QL
LCS	Daily or 1 per 20 samples	85-115%	Identify source of problem, correct and reanalyze	Laboratory Analyst	Accuracy	85-115%R

Laboratory Duplicate	1 per 20 samples	±20% RPD	Reanalyze. Re-perform calibration check if still outlying.	Laboratory Analyst	Precision	± 20% RPD
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Control limits for the LCS based on method criteria.

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Documents Prepared/Submitted by Arrowhead				
COC Records	Photographs	Subcontract	Validated Data Reports	Project Contract, Drawings and Specifications
Airbills	Equipment Calibration and Maintenance Log	Lower Tier Subcontracts	Data Validation SOPs	Project Work Plan
Sample Tracking Log/Sheets	Field Data Collection Logs	Purchase Orders	Data Package Completeness Checklist (Data Validator)	UFP-QAPP
Field Logbooks	Log of Water Quality Parameters	Certified Payroll	Corrective Action Reports	Contractor Quality Control Plan
Daily Quality Control Summary Reports	PID Logs	Project Correspondence	Field Sampling Audit Plans, Reports and Checklists	Environmental Protection Plan
	Meteorological Data	Corrective Action Forms	-	Health and Safety Plan
	Sample Disposal and Waste Manifests	Project Correspondence	-	Survey Records
-		-	-	O&M monthly reports
-		-	-	Personnel Certifications
-		-	-	Electronic Data Deliverables
-		-	-	Data Qualification Assessment
-		-	-	Water Level Measurement Record

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Documents Prepared/Submitted by the Respective Analytical Laboratory				
-	-	Data Packages (Case Narratives, Sample Results, QC Summaries and Raw Data (detailed in laboratory SOPs).	Analytical sample results	Electronic Data Deliverables
-	-	Standards Tracking Logs	Test America certifications	-
-	-	Sample Preparation Logs	Test America QA Plan (on file with EPA, CDM and RA Subcontractor)	-
-	-	Run Logs	Corrective Action Reports	-
-	-	Corrective Action Reports	-	-
-	-	Corrective Action Forms	-	-
-	-	-	-	-

QAPP Worksheet #30
Project Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
Soil Sampling During Earthwork Construction Activities							
Imported Granular Material Sampling*							
Soil	TCL VOCs	Low	See Worksheet #18	SOM01.3	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Rayburn Lavigne	TBD
	TAL Metals (including mercury)	Low	See Worksheet #18	ISM01.3	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Rayburn Lavigne	TBD
	TCL SVOCs including aniline	Low	See Worksheet #18	SOM01.3	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Rayburn Lavigne	TBD
	PCBs	Low	See Worksheet #18	SOM01.3	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Rayburn Lavigne	TBD

QAPP Worksheet #30
Project Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
	Pesticides including parathion	Low	See Worksheet #18	SOM01.3	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Rayburn Lavigne	TBD
Soil	Herbicide (2,4,5-T, silvex and 2,4-D)	Low	See Worksheet #18	SW846 8151	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Rayburn Lavigne	TBD
Excess/Unsuitable Material Sampling							
Soil	TBD by requirements of disposal facility	Standard	See Worksheet #18	TBD	14-Day	TestAmerica 30 Community Drive South Burlington, VT 05403 Rayburn Lavigne	TBD
Geotechnical Testing							
Soil	Standard Proctor	NA	See Worksheet #18	ASTM D698	7-Day	CM Testing	TBD
Soil	Grain Size	NA	See Worksheet #18	ASTM D421-85 & D422-63	7-Day	CM Testing	TBD

QAPP Worksheet #30
Project Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
Groundwater Treatment System							
Initial Testing Program							
Groundwater – Influent Sampling	TCL VOCs	Trace	See Worksheet #18	SOM01.3	7-Day	Test America	TBD
	Total Iron	Low (ICP-MS/AES)	See Worksheet #18	ISM01.3	7-Day	Test America	TBD
Groundwater – Process Sampling after EQ Tank	TCL VOCs and Total Iron	Trace	See Worksheet #18	SOM01.3 ISM01.3	7-Day	Test America	TBD
Groundwater – Compliance Sampling after Static Mixer)	TAL Metals, Mercury, and Cyanide	Low	See Worksheet #18	ISM01.3	7-Day	Test America	TBD
	TCL VOCs	Trace	See Worksheet #18	SOM01.3	7-Day	Test America	TBD
	Oil and Grease	Low	See Worksheet #18	1664a	7-Day	Test America	TBD
	Nitrate/Nitrite	Low	See Worksheet #18	353.2	7-Day	Test America	TBD

QAPP Worksheet #30
Project Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP¹	Data Package Turnaround Time	Laboratory / Organization (name, address, contact person & telephone number)	Backup Laboratory / Organization² (name, address, contact person & telephone number)
	TSS, TDS	Low	See Worksheet #18	SM 2540C, SM 2540D	7-Day	Test America	TBD
O&M							
Groundwater – Influent Sampling	TCL VOCs	Trace	See Worksheet #18	SOM01.3	14-Day	DESA	TBD
	Total Iron	Low	See Worksheet #18	ISM01.3	14-Day	DESA	TBD
Groundwater – Compliance Sampling after Static Mixer	TAL Metals, Mercury, and Cyanide	Low	See Worksheet #18	ISM01.3	14-Day	DESA	TBD
	TCL VOCs	Trace	See Worksheet #18	SOM01.3	14-Day	DESA	TBD
	Oil and Grease	Low	See Worksheet #18		14-Day	DESA	TBD
	Nitrate/Nitrite	Low	See Worksheet #18		14-Day	DESA	TBD
	TSS, TDS	Low	See Worksheet #18	SM 2540C, SM 2540D	14-Day	DESA	TBD
Optional Scope <i>TBD based on soil and groundwater screening results from the pre-remedial action soil borings. If option is implemented then the sampling and analysis will be similar to the base scope for baseline, pre-final and final sampling events.</i>							

1. Please note that the required quantification limits and CLP method options are detailed on worksheet 15

**QAPP Worksheet #31
Planned Project Assessments Table**

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Sample collection and documentation	Once if warranted	Internal	Arrowhead	TBD	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Health and Safety	Once if warranted	Internal	Arrowhead	Scott Siegwald (CHSO)	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Field Audit	Once if warranted	Internal	Arrowhead	Approved field auditor	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Field Audit	Once, at a minimum	Internal	Arrowhead	Approved field auditor	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Office Audit	Once if warranted	Internal	Arrowhead	Approved Office Auditor	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Laboratory Audit	Once if warranted	Internal	Arrowhead	Approved laboratory auditor	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
QAPP	Annually	Internal	Arrowhead	QA Coordinator	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)
Data Review	As required	Internal	Arrowhead	Arrowhead Staff	Doug Ronk (PM)	Doug Ronk (PM)	Greg Wallace (QCO)

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Sample collection and documentation	Memorandum	Doug Ronk (PM)	Day of audit	Verbal briefing; Corrective Action Notice if immediate corrective action not possible or critical violations noted	Greg Wallace (CQO)	Immediate CA required where possible; otherwise as specified on the CA Notice, typically 15 to 30 days from date of CA Notice
Health and Safety	Audit checklist	Doug Ronk (PM)	Notify by phone immediately Report 1 week after audit	Memorandum and checklist	Greg Wallace (CQO) Scott Siegwald (CHSO)	
Field Audit	Field Audit Report (Subcontractor)	Doug Ronk (PM)	Provide summary of findings to field team on day of audit; Draft Report due within 10-15 days	Corrective Action Plan provided to CDM	Greg Wallace (CQO)	
Field Audit	Field Audit Report	Doug Ronk (PM)	Provide summary of findings to field team on day of audit; Draft Report due within 10-15 days	Corrective Action Plan	Greg Wallace (CQO)	

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Office Audit	Office Audit Report	Doug Ronk (PM)	Provide summary of findings to SM on day of audit; Draft Report due within 10-15 days	Memorandum	Greg Wallace (CQO)	
QAPP	Memorandum	Doug Ronk (PM)	Draft Report due 30 days	Memorandum and/or FCRs	Greg Wallace (CQO)	
Data Review	Memorandum	Doug Ronk (PM)	Notify by phone immediately	Memorandum	Greg Wallace (CQO)	

QAPP Worksheet #33
QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Change Requests	As needed	Promptly – prior to initiation of change or as requested by EPA	Doug Ronk (PM)	QAPP recipients
QAPP Addendums	As needed	As per client request	Doug Ronk (PM)	QAPP recipients
Field Audit Report	Once (if audit is conducted)	15 days (draft) and 30 days (final) after audit	Doug Ronk (PM)	CDM Greg Wallace (QCO)
Office Audit Report	Once (if audit is conducted)	15 days (draft) and 30 days (final) after audit	Doug Ronk (PM)	
Corrective Action Reports	As required on CA request	As per corrective action request	Doug Ronk (PM)	
Daily Quality Control Summary Reports (DQCSR)	Daily during construction	Next Day	Joe Cotter (SM)	CDM Doug Ronk (PM)
Data Usability Assessments	With each Measurement Report (unless data previously reported)	With each Measurement Report	Data Validator	CDM Doug Ronk (PM)
Monthly O&M Reports	Monthly	Monthly	Doug Ronk (PM)	CDM

**QAPP Worksheet #34
Verification (Step I) Process Table**

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of custody	Form will be internally reviewed upon completion and verified against field logs, laboratory report and QAPP. Review will be conducted with completion of each measurement report.	Internal	Data Validator
Daily QC/Summary Report	Daily Quality Control Summary Report will be verified with field log books to ensure correct reporting of information. Review will be conducted with completion of each report.	Internal	Doug Ronk (PM)
		External	CDM Smith
Field Logbooks	Field logbooks will be reviewed for accuracy and completeness and placed in project file.	Internal	Joe Cotter (SM)
Laboratory Logbooks	Laboratory logbooks will be reviewed for accuracy and completeness and placed in project file.	External	Subcontract Laboratory, Test America
Field and Laboratory data and QC Report	Data validation reports, QAPP, FCRs and outputs of the EQuIS database will be used to prepare the project data quality and usability assessment report. The data will be evaluated against project DQOs and measurement performance criteria, such as completeness.	Both	Data Validator
Field Sampling Procedures	Evaluate whether field sampling procedures were followed with respect to equipment and proper sampling support using audit and sampling reports, field change request forms and field logbooks.	External	CDM Smith
		Internal	Clayton Nystrom (SQCO)
Laboratory Data	All laboratory data will be verified by the laboratory performing the analysis for completeness and technical accuracy prior to submittal to EPA. Subsequently, EPA or its contractor will evaluate the data packages for completeness and compliance. Table 9 of the IDQTF UFP-QAPP shows items for compliance review.	External	CDM Smith
Electronic Data Deliverables (EDDs)	Determine whether required fields and format were provided.	Internal	Doug Ronk (PM)
QAPP	All planning documents will be available to report writers and reviewers to allow reconciliation with planned activities and objectives.	Internal /External	All data users

QAPP Worksheet #35
Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	Methods	Records support implementation of the SOP - sampling and analysis	Chemical Quality Control Officer, Scott Siegwald.
IIa	Chain of Custody	Examine traceability of data from sample collection to generation of project reported data. Provides sampling dates and time; verification of sample ID; and QC sample information.	
IIb	Data Narrative	Determine deviations from methods and contract and the impact on data use.	
IIb	Audit Report	Reports used to validate compliance of field sampling, handling and analysis activities with the QAPP.	
IIb	Project Quantification Limit	PQL achieved as outlined in the QAPP and that the laboratory successfully analyzed a standard at the QL.	
IIb	Field data and Field QC	Field logbooks and field data results will be compared against the QAPP measurement performance criteria and data validation SOP requirements.	
IIb	Data Package	Used to perform data validation on 100% of all CLP data. All data from Test America will be validated by a third party chemist Ensure that all analytical procedures were followed. Corrective actions will be taken and documented when applicable per specific methods. Deviations will be documented. Data will be qualified in accordance with specific methods.	

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Date Validator (Title, Organization)
IIa / IIb	Soil	TCL VOCs	Low	SOP HW-33, rev 1	Subcontractor's validator/ designee
IIa / IIb	Soil	TCL SVOCs	Low	SOP HW-35, rev 1	Subcontractor's validator/ designee
IIa / IIb	Soil	TAL Metals including mercury	Low	SOP HW-2, rev 13	Subcontractor's validator/ designee
IIa /IIb	Soil	TCL Pesticides	Low	SOP HW-36, rev 1	Subcontractor's validator/ designee
IIa / IIb	Soil	TCL PCBs	Low	SOP HW-37, rev 1	Subcontractor's validator/ designee
IIa / IIb	Soil	Herbicides	Low	SOP HW-17, rev 2	Subcontractor's validator/ designee
IIa / IIb	Groundwater	TCL VOCs	Trace	SOP HW-34, rev 1	Subcontractor's validator/ designee
IIa / IIb	Groundwater	TAL Metals including mercury and cyanide	Low	SOP HW-2, rev 13	Subcontractor's validator/ designee
IIa / IIb	Groundwater	TDS, TSS	Low	USEPA National Functional Guidelines (2004), EPA method SM 2540C and SM 2540D (as applicable)-	Subcontractor's validator/ designee
IIa / IIb	Groundwater	Oil and Grease	Low	USEPA National Functional Guidelines (2004), EPA method 1664	Subcontractor's validator/ designee
IIa / IIb	Groundwater	Nitrate/Nitrite	Low	USEPA National Functional Guidelines (2004), EPA Method 353.2	Subcontractor's validator/ designee
IIa /IIb	Air	VOCs	Low	SOP HW-31 Revision 4	Subcontractor's validator/ designee

Note: Ferrous iron and grain size analyses will not be validated.

QAPP Worksheet #37
Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

The PM (Doug Ronk) will be responsible for information in the Usability Assessment. He will be responsible for assigning the work to the Chemical Quality Control Officer who will be preparing the Data Usability Assessment. Note that the Data Usability Assessment will be conducted on validated data. The results of the Data Usability Assessment will be presented with each measurement report. After the Data Usability Assessment has been performed, data deemed appropriate for use will then be used with each measurement report. The following items will be assessed and conclusions drawn based on their results.

Precision – Results of laboratory duplicates will be assessed during data validation and data will be qualified according to the data validation procedures cited on Worksheet #36. Field duplicates will be assessed by matrix using the RPD or absolute difference for each pair of results reported in accordance with the MPCs on the Worksheets #12 and #28. Absolute difference will be used for low results as described in worksheets 12 and 28. A discussion summarizing the results of laboratory and field precision and any limitations on the use of the data will be described.

Field duplicates - The data assessor will review the data validation report. If the field duplicate comparison is not included, it will be performed by the assessor. The data assessor will review the extent of exceedance of the field duplicate criteria. The sample results will be flagged according to the data validation protocol. Based on this review, the data assessor will determine whether the exceedance is due to inherent soil heterogeneity or the result of sample handling in the field or laboratory. This information will be included in the data assessment report. As an added measure, the field team leader will be asked to inspect the soil coning and quartering procedures and re-train staff if needed.

Accuracy/Bias Contamination – Results for all laboratory blanks will be assessed as part of the data validation. During the data validation process the validator will qualify the data following the procedures described on Worksheet #36. A discussion summarizing the results of laboratory accuracy and bias based on contamination will be presented and any limitations on the use of the data will be described.

Overall Accuracy/Bias – The results of instrument calibration laboratory control samples and matrix spike recoveries will be reviewed and data will be qualified according to the data validation procedures cited on Worksheet #36. A discussion summarizing the results of laboratory accuracy and any limitations on the use of the data will be described.

Sensitivity – Data results will be compared to criteria provided on Worksheet #15. A discussion summarizing any conclusions about sensitivity of the analyses will be presented and any limitations on the use of the data will be described.

QAPP Worksheet #37
Usability Assessment

Representativeness – A review of adherence to the sampling plan, field procedures and of project QA audits will be performed in order to assess the representativeness of the sampling program. Data validation narratives will also be reviewed and any conclusions about the representativeness of the data set will be discussed.

Comparability – The results of this study will be used in conjunction with existing data to make qualitative and quantitative assessments of the data to be used to produce the Site reports.

Reconciliation – The DQIs presented in Worksheet #12 will be examined to determine if the MPC were met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of major impacts observed from data validation, data quality indicators and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. Based on the data, the usability of the data for each analysis will be determined. The combined usability of the data will determine if the DQIs were met and whether project goals were achieved. Conclusions will be drawn and any limitations on the usability of any of the data will be described.

Completeness - The database will be queried to summarize the number of samples in each analytical fraction that are estimated and rejected. This data will be used along with the planned samples indicated in the QAPP to calculate the completeness of the obtained data set. These results will then be compared to the MPC in Worksheets #12 and #28. Completeness evaluation results will be used to evaluate whether data gaps exist and whether critical data points or data results are missing.

The following equations will be used :

1. To calculate field duplicate precision: $RPD = 100 \times 2 |X1 - X2| / (X1 + X2)$ where X1 and X2 are the reported concentrations for each duplicate or replicate
2. To calculate completeness: $\% \text{ Completeness} = V/n \times 100$ where V= number of measurements judged valid; n = total number of measurements made and
 $\% \text{ Completeness} = C/x \times 100$ where C= number of samples collected; x = total number of measurements planned

2. Describe the evaluative procedures used to assess overall measurement error associated with the project:

Arrowhead's data assessor will determine if quality control data is within specifications (MPC) through the data assessment validation process IIb.

3. Identify the personnel responsible for performing the usability assessment: Chemical Quality Control Officer

**QAPP Worksheet #37
Usability Assessment**

4. Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The usability report will include a discussion of the accuracy, precision, representativeness, completeness and comparability of the data set and deviations from planned procedures and analysis and the impact on the project objectives. Tables will be prepared, including: a summary of planned samples, collected samples and parameters analyzed; detections in field and trip blanks; comparison of field duplicates; estimated and rejected data; and a comparison of planned and actual detection limits.

The procedures described above will be used to ensure that the data generated will meet the data quality objectives outlined in the remedial design specifications to ensure the data meets the needs of the RA. The data generated will be used to complete the following steps in preparing the interim RA Report.

- Confirming the achievement of remedial system performance requirements
- Confirming compliance with NYSDEC SPDES and Air Pollution Permit Equivalent
- Assessing groundwater treatment system RA progress and support decisions regarding treatment system operation and optimization
- Identifying data gaps - As soon as data gaps are identified during the RA Arrowhead will discuss them with CDM. To identify data gaps, Arrowhead will evaluate the analytical results by media and determine if results indicate levels or locations of contamination that need to be further investigated. Identifying data gaps shall be reported as soon as possible during the RA so that corrective action could be made.
- Using qualified data - CDM utilizes all data not rejected during validation to determine compliance with the RA objectives.
- Deciding if high results are legitimate or outliers - CDM will assume that all data not rejected during validation will be considered in determining compliance with the RA objectives. CDM will work with EPA if there is a concern about the statistical validity of the sample results. In particular, high "outlier" results that have no surrounding comparable results as confirmation will be discussed with EPA.



September 30, 2014

Mr. Thomas Mathew, P.E.
Project Manager
CDM Federal Programs
110 Fieldcrest Avenue
Edison, New Jersey 08837

**Subject: Contract Submittal Review – 1010-1
Old Roosevelt Field Contaminated Groundwater Area Superfund Site, Southern
Plume Plant Expansion**

Dear Mr. Mathew:

This letter presents the responses by Arrowhead Contracting to your comments on the subject submittal. Comments have been incorporated in the shop drawings as appropriate or a response has been generated as indicated in this letter.

If you have any questions or comments please contact me at (913) 814-9994.

Sincerely,

A handwritten signature in black ink that reads "Doug Ronk". The signature is written in a cursive, flowing style.

Doug Ronk
Project Manager

CDM Comment:

1. General – All references to “CDM” should be changed to “CDM Smith”.

Arrowhead Response:

The text has been revised.

2. Section 1.3 – Please provide a brief overview of the work to be performed. For example, clarify there is an existing treatment system with new wells being added to the well network and that treatment system equipment upgrades will be performed, etc.

Arrowhead Response:

The text has been revised to include a summary of work.

3. Section 1.3 – Please add the following to the list of construction activities: clearing and grubbing, and site restoration including pavement reconstruction, fence installation, and seeding.

Arrowhead Response:

The text has been revised.

4. Section 2.4 – The directional drilling subcontractor should be included in the subcontractor list.

Arrowhead Response:

The “Utility Contractor” includes both open cut and directional drilling installation. The text has been revised to indicate both tasks by the same subcontractor.

5. Section 3.0 – Please include demolition and restoration of the chain-link fencing.

Arrowhead Response:

A brief narrative of fence to be installed and temporarily removed during construction has been added in Section 3.4.6.

6. Section 3.3 – Many of the subsections included here are not part of site preparation and should be moved to a separate section.

Arrowhead Response:

The text has been revised, a new section has been created to discuss site work.

7. Section 3.3 – Please include that a geophysical survey shall be performed to locate potential underground structures and utilities.

Arrowhead Response:

Text in the first paragraph of section 3.3 has been revised.

8. Section 3.3.1 – Please clarify if pre-construction photographs will be performed per specification section 01380.

Arrowhead Response:

The text has been revised.

9. Section 3.3.3 – Please include that a well survey of extraction wells SEW-1S, SEW-1I, and SEW-1D will be performed.

Arrowhead Response:

The text has been revised.

10. Section 3.3.5 – A clarification that the soil cleanup objectives will be based on unrestricted use should be included.

Arrowhead Response:

The text has been revised. Please note this section is now 3.4.1.

11. Section 4.0 – A section describing the directional drilling should be provided.

Arrowhead Response:

A review of the directional drilling has been added in Section 4.7 with reference to Figure 3-1 (draft directional boring information).

12. Section 4.7 – The Environmental Protection Plan indicated that temporary dewatering systems for the trenches and excavations are not expected to be required. Please reconcile.

Arrowhead Response:

The text has been revised. Please note this section is now 4.8.

13. Section 4.9 – Include the specification for the washed sand that will be used for the pipe bedding.

Arrowhead Response:

The text has been revised. It is anticipated the excavated native sand will be used as pipe bedding material. If excavated material is found unsuitable imported sand meeting the gradation requirements will be used. Please note this section is now 4.10.

14. Figure 2-1 – Please fill in the missing personnel. Include the following:

- CDM Smith QA Manager - Jo Nell Mullins
- CDM Smith Health and Safety Manager - Shawn Oliveira
- CDM Smith Regional QA Coordinator – Jeniffer Oxford
- CDM Smith H&S Coordinator – Tonya Bennett
- CDM Smith Onsite Representative – Katelyn Reepmeyer
- EPA RAC2 QA Officer – William Sy

Arrowhead Response:

The text has been revised.

15. Figure 3-1 – Please confirm, if the suggested jacking and receiving locations are correctly shown on this drawing.

Arrowhead Response:

The drawing has been revised to indicate the access pits will be located along the pipe alignment.

**CONSOLIDATED PLANNING DOCUMENTS
REMEDIAL CONSTRUCTION ACTIVITIES
OLD ROOSEVELT FIELD CONTAMINATED GROUNDWATER AREA SUPERFUND SITE
GARDEN CITY, NEW YORK**

SUBCONTRACT NO. 3320-048-001-CN

Submitted to:

**CDM SMITH Federal Programs Corporation
110 Fieldcrest Avenue, 6th Floor
Edison, New Jersey 08837**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher
Lenexa, Kansas 66219**

Revision 1

September 2014

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List of Acronyms

Arrowhead	Arrowhead Contracting, Inc.
ASTM	American Society for Testing and Materials
bgs	below ground surface
CDM Smith	CDM Federal Programs Corporation
C&D	construction & demolition
CFR	Code of Federal Regulation
CHSO	Corporate Health and Safety Officer
CQCP	Contractor Quality Control Plan
CY	cubic yard
DCA	Dichloroethane
DCE	Dichloroethylene
DSC	Designated Safety Coordinator
DQCR	Daily Quality Control Report
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
gpm	Gallons per minute
GWTF	Groundwater Treatment Facility
H&S	Health and Safety
HDPE	High Density Polyethylene
ITP	Initial Testing Program
MTBE	Methyl-tert-butyl ether
NPL	National Priority List
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
O&M	Operations and Maintenance
ORF	Old Roosevelt Field Contaminated Groundwater Area Superfund Site
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethylene
P&ID	Process and Instrumentation Diagram
PID	Photoionization Detector
PLC	Programmable Logic Controller
PM	Project Manager
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
RCA	Recycled Concrete Aggregate
RFI	Request for Information
RFP	Request for Proposal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SPDES	State Pollutant Discharge Elimination System
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan

List of Acronyms

SOW	scope of work
SVOC	Semi-Volatile Organic Compounds
T&D	transportation and disposal
TAL	Target Analyte List
TBP	Trenching and Backfill Plan
TCE	Trichloroethylene
TCL	Target Compound List
VOC	volatile organic compound
WP	Work Plan

1.0 Introduction

This document constitutes the Site Preparation Plan, Excavation, Trenching, and Backfill Plan, and Work Plan for services associated with remedial construction activities at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site (ORF) located in Garden City, Nassau County, New York. Arrowhead Contracting, Inc. (Arrowhead) prepared this document for CDM Federal Programs Corporation (CDM Smith) under Subcontract #3320-048-001-CN. This document covers construction activities specifically conducted by Arrowhead in accordance with the subcontract scope of work (SOW).

Note: The Site Safety and Health Plan (SSHP), Contractor Quality Control Plan (CQCP), Quality Assurance Project Plan (QAPP) and Environmental Protection Plan (EPP) are stand-alone documents and will be submitted under separate covers.

1.1 Site Description

The Old Roosevelt Field Superfund Site is an area of groundwater contamination within the Village of Garden City, in central Nassau County, New York. The site is located on the eastern side of Clinton Road, approximately 0.6 mile south of the intersection with Old Country Road. The site includes a thin strip of open space along Clinton Road (known as Hazelhurst Park), a large retail shopping mall, and several office buildings (including Garden City Plaza) that share parking space with the shopping mall.

Two municipal water supply well fields are located south (hydraulically downgradient of the Site). The Village of Garden City public supply wells (designated at GWP-10 and GWP-11) are located just south of the site boundary, on the eastern side of Clinton Road. The Hempstead well field is located approximately 1.5 miles south of the Garden City supply wells. Two storm water recharge basins are directly east and south of the mall area. The eastern basin, Pembroke, is located on property owned by the mall. The basin to the south is Nassau County Recharge Basin number 124.

Groundwater at the site is contaminated with volatile organic compounds (VOCs), particularly chlorinated VOCs such as tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), dichlorodifluoromethane and 1,2-dichloroethane (1,2-DCA), and non-chlorinated VOCs such as methyl ter-butyl ether (MTBE). The remedy, as defined in the September 2007 Record of Decision (ROD), involves groundwater extraction and ex-situ treatment (pump and treat) in order to expedite the restoration of water quality in the aquifer in comparison with natural processes alone, and provide for vapor intrusion mitigation, if deemed necessary.

1.2 Site History

The Site was used for aviation activities from 1911 to 1951. The United States military began using the Hempstead Plains field prior to World War I to train Army and Navy officers and as a training center for military pilots. In 1918, the Army changed the name of the airfield to Roosevelt Field.

After World War I, the US Air Service authorized aviation-related companies to operate from Roosevelt Field, but maintained control until July 1, 1920, at which time the Government sold its buildings and relinquished control of the field. Subsequently, the property owners sold portions along the southern edge of the field and split the remainder of the property into two flying fields. The eastern half continued as Roosevelt Field, and the western half became known as Curtiss Field. Both fields were bought in 1929 by Roosevelt Field, Inc. and the property was once again called Roosevelt Field.

During World War II, Roosevelt Field was once again used by both the Army and Navy. The Army used the field to provide airplane and engine mechanics training to personnel. As of March 1942, there were 6 steel/concrete hangars, 14 wooden hangars, and several other buildings at Roosevelt Field, which were used to receive, fuel, crate and ship Army aircraft. In November 1942, the Navy Bureau of Aeronautics established a modification center at Roosevelt Field to install British equipment into US aircraft for the British Royal Navy. The Navy was responsible for aircraft repair and maintenance, preparation and flight delivery of lend-lease aircraft, and metal work required for installation of British modifications. The facility also performed salvage work of crashed Royal Navy planes. The Navy vacated all but six hangars shortly after the war ended. In August 1946, Roosevelt Field again operated as a commercial airport until it closed in May 1951.

Chlorinated solvents such as PCE and TCE have been widely used for aircraft manufacturing, maintenance, and repair since the later 1930s. Several military instruction manuals for aircraft maintenance and repair were issued during this time period which was specifically related to the use of solvents such as TCE for cleaning airplane parts and for de-icing. The types of airplanes designated for solvents were reportedly present at the Site during World War II. As such, use of chlorinated solvents at the Site was very likely to have occurred.

Soon after the airfield closed, industrial plants for precision electronic instruments were under construction at Roosevelt Field and further development was planned. The large Roosevelt Field Shopping Center was constructed at the site and opened in 1957. Three of the old Navy hangars remained standing until sometime after June 1971, with various occupants, including a moving/storage firm, discotheque, amusement center, and bus garage.

Garden City installed two public supply wells, GWP-10 and GWP-11 in 1952, at what had been the southwest corner of the airfield. These two wells were put into service in 1953. Over the subsequent

years, several other supply wells and cooling water wells were installed and operated the former Roosevelt Field. In the late 1970s and early 1980s, investigations conducted by Nassau County found contaminants TCE and PCE in supply wells GWP-10 and GWP-11. High levels of contamination were also found in cooling water wells at the Site. The Site was listed on the National Priorities List (NPL) on May 11, 2000.

From June 2005 to December 2006, CDM Smith, the Remedial Action Contractor for the Environmental Protection Agency (EPA), performed a remedial investigation (RI) at the Site to investigate the extent of groundwater contamination and to characterize the site geologic and hydrogeologic settings. During the RI, a total of 8 multiport monitoring wells were installed and two rounds of groundwater sampling were collected.

Following the RI, a feasibility study (FS) was completed to evaluate the remediation alternatives to treat the contaminant plume. Based on the findings in the RI and the recommendations in the Final FS, a ROD was signed in September 2007, selecting groundwater extraction and in-situ treatment technologies to address the Site groundwater contamination.

A groundwater treatment facility was constructed in 2011 which extracts, conveys, and treats via air stripping, water from three groundwater extraction wells. This system operates at an average flow rate of approximately 200gpm. Treated water is discharged to stormwater basin #124 through a storm water inlet located on Clinton Road. To date the treatment facility has extracted and treated approximately 210 million gallons of TCE contaminated groundwater.

1.3 Construction Activities

The goal of this project is to complete expansion of the Groundwater Treatment Facility (GWTF). The existing GWTF will be upgraded to treat a maximum flow rate of 500gpm. Work within the plant required to facilitate the increased flow will include replacement of transfer pumps P-1 and P-2, installation of three additional trays to the air stripper (for a total of 6), replacement of blower B-1, and modification to process piping and electrical distribution equipment. In addition to work within the treatment facility three extraction wellhead vaults will be constructed, approximately 2,000 linear feet of groundwater conveyance line will be installed, a new local control panel will be installed at the southern well field extraction wells, and a new electrical service connection will be constructed at the southern well field.

Arrowhead's scope of work includes the following activities:

- Preparing shop drawings
- Obtaining required permits
- Mobilizing to the site

- Preparing the site, including setting up work zones, support areas, and laydown area (i.e. for equipment/vehicle/materials storage), and locating utilities
- Clearing and grubbing
- Installing site utilities
- Installing GWTF transmission piping and well head construction
- Site restoration (including pavement restoration and seeding)
- Fence installation
- Demolition of selected GWTF equipment
- Installation of new GWTF equipment
- System proveout
- Completion of the Initial Testing Program
- Completing site cleanup/demobilization
- Completing post-construction submittals
- 1 year of operations and Maintenance

2.0 General Requirements

This section presents the general requirements for construction consistent with the subcontract scope of work.

2.1 Required Meetings

Arrowhead personnel will attend periodic meetings through completion of site work. Prior to initiating the construction phase of the project, the weekly meeting will be held via conference call. During the construction phase, all meetings will be held at the Site. These meetings will include, but are not limited to, a pre-construction meeting, daily tailgate meetings, weekly progress meetings, quality control meetings, and project orientation safety meetings.

- **Pre-construction Meeting** – Prior to any on-site construction work, a pre-construction meeting will be held by CDM Smith with Arrowhead personnel at the Site.
- **Daily Tailgate/Pre-Task Safety Planning Meetings** – All Arrowhead and lower-tier subcontractor employees working onsite that day will attend daily tailgate/pre-task safety planning meetings to be held each morning at the jobsite. The meeting is anticipated to be 15 minutes in duration. Refer to the SSHP for the specific content and documentation requirements associated with the daily tailgate safety meeting.
- **Weekly Progress Meetings** – Weekly progress meetings will be held at a time acceptable to CDM Smith. Arrowhead will provide a status of the project, a review of work completed in the prior week, and a two-week look-ahead schedule of work to be completed. The Weekly Progress Meetings will also include a summary of green remediation activities performed including any relevant supporting documents attached (quantities of recycled materials installed, utility receipts, etc.).
- **Quality Control (QC) Meetings** – QC meetings will be held by CDM Smith with Arrowhead on a frequency set by the pace of the work, or as called by the CDM Smith Project QC Manager. These meetings will be held at the site and will typically discuss the preparatory, initial, and follow-up process associated with definable features of work (refer to the quality assurance/quality control (QA/QC) section of this document for further details.
- **Project Orientation Safety Meeting** – All personnel, including subcontractors, working at the site will attend a site-specific orientation covering the topics listed in Section 11.3 of the SSHP.

2.2 Reporting Obligations

During the construction phase of the project, Arrowhead's Site Supervisor will be responsible for preparing a daily field activity summary that describes the work performed each day. The field activity summary will include, at a minimum, the following:

- Work date, names, title, and hours worked onsite of all subcontractors and lower-tier subcontractor personnel onsite.

- Time that work began and ended.
- Results of daily equipment and materials inspections including corrective actions involved, and maintenance and repairs resulting from these inspections.
- Any unusual occurrence, including visitors, injuries, breakdowns, weather, or any other out-of-the-ordinary event.
- Levels of personnel protection, and other information regarding crew Health and Safety (H&S).
- Any disposal documentation received (copies of signed manifests, etc)
- Equipment/material received onsite that day
- Equipment used onsite that day and hours used
- All other documentation developed during the day, including a summary of the work performed
- Photo documentation.

Each of these items will be documented on Arrowhead's Daily Quality Control Report (DQCR) to CDM Smith.

2.3 Project Personnel

Site field personnel will include one person dedicated as the Site Supervisor and a second person who will be responsible for quality and safety. Arrowhead will employ local craft labor (i.e. equipment operators, carpenters, etc.) throughout the project as needed for each phase of work.

The Site Supervisor will be responsible for oversight of all activities and management of all lower-tier subcontractors. The Site Supervisor is the senior onsite Arrowhead representative and is responsible for the implementation and enforcement of all work plans and specifications. The Site Supervisor is also responsible for maintaining contact with the Arrowhead Project Manager (PM).

The Quality Control (QC) Officer will have onsite QC authority for all work performed by Arrowhead or lower-tier subcontractors. The QC Officer will also serve as the Site Safety and Health Officer (SSHO) and will conduct inspections to ensure that operations are conducted in accordance with the SSHP, Occupational Safety and Health Administration (OSHA) regulations, and the subcontract specifications. The SSHO reports directly to the Corporate Health and Safety Officer (CHSO). An open dialogue between the SSHO and the CHSO will be maintained in order to quickly address safety issues and implement corrective actions as necessary. Refer to the SSHP for further details regarding the SSHO's responsibilities. The QC Officer will also be responsible for performing all three-phase inspections.

Arrowhead's PM will oversee the project from Arrowhead's home office and/or the field office. The Project Manager's responsibilities will include regular communication and correspondence with the CDM Smith Project Manager, coordination with field crew, updating the project schedule throughout field

construction, procurement support, weekly job cost tracking, monthly invoicing, preparation of Requests for Information (RFIs) (as needed), and attendance at project-related conference calls.

Table 2-1 identifies the project personnel from Arrowhead, including their specific project responsibilities and contact information. Refer to Figure 2-1 and the Contractor Quality Control Plan for additional information related to project personnel roles and responsibilities.

2.4 Subcontractors

Arrowhead's lower-tier subcontractors for this project will include:

- Land surveyor
- Geotechnical testing
- Utility contractor (open cut and directional drilling)
- Electrician
- Chemical testing laboratory
- Waste disposal facility/transporter
- Treatment equipment fabricator

Subcontractors are responsible for the H&S of their employees and for complying with the standards established in the SSHP and all other project requirements. The following are general requirements that apply to subcontractors:

- All subcontractors under the direction of Arrowhead will report to the Site Supervisor.
- An assigned safety representative for each subcontractor will be present on any day that work is being performed. The name of the assigned safety representative will be conveyed to the SSHO.
- Planned operations for the day will be verbally conveyed to the Site Supervisor at the beginning of each day. Any changes in scopes of work or specified quantities will also be conveyed to the Site Supervisor on a regular basis.
- The Site Entry Log will be signed at the beginning and end of each workday by all subcontractor employees working on-site.
- All subcontractor personnel will attend a project safety orientation (refer to Section 11.3 of the SSHP) prior to beginning work on-site.
- All subcontractor personnel will attend the morning tailgate safety meeting (refer to Section 2.1). If scheduling precludes attendance, then subcontractors will hold and document their own safety meeting. Safety meeting documentation will be submitted to the Designated Safety Coordinator (DSC).
- Heavy equipment is to be inspected daily by the equipment operator. Inspection documentation will be submitted to the SSHO.
- Subcontractors are required to frequently inspect work sites for safety deficiencies and correct all deficiencies. Documentation of these inspections, as well as the corrective actions implemented, will be submitted to the SSHO.
- Work completed each day will be communicated to the Site Supervisor at the end of the day.
- Since security is a concern at the construction site, all contractor and subcontractor personnel will have an identification badge during construction.

2.5 *Requests for Information*

When information/direction is required, Arrowhead will submit Requests for Information (RFIs) in writing to the CDM Smith Project Manager. The RFI will include, at minimum, a complete description of the problem/question/concern and the PM's signature and date of request. Each RFI will be sequentially numbered. Arrowhead will work with CDM Smith as necessary to expedite the reply to the RFI.

2.6 *Project Schedule*

Based on a thorough review of the statement of work, Arrowhead has developed a preliminary schedule (refer to Figure 2-2) for site activities. Arrowhead's PM will update the project schedule as construction activities progress.

3.0 Technical Requirements

Arrowhead will furnish all labor, equipment, materials, lower tier subcontractors, supplies, and all other items necessary to perform the scope of work as described in Section 1.3.

3.1 Preparation of Design Documents

Arrowhead will prepare a shop drawing package consisting of a Consolidated Planning Document (Site Preparation Plan, Excavation, Trenching and Backfill Plan, and Work Plan combined as a single document), Site Safety and Health Plan (SSHP), Contractor Quality Control Plan (CQCP), Environmental Protection Plan (EPP), Quality Assurance Project Plan (QAPP), GWTF shop drawings, and proposed product manufacturers cut sheets. Work will not be initiated until the applicable planning documents have been approved by CDM Smith.

3.1.1 Pre-design Geotechnical Investigation

As part of the design for installation of conveyance piping under Stewart Avenue a geotechnical investigation to determine soil conditions will be completed. Two borings, one on either end of the directional bore (refer to Figure 3-1) will be installed. Each boring will be completed using hollow stem auger method to an estimated depth of 30 feet bgs with samples collected from 10 feet to 30 feet using a split spoon sampler. Blow counts required to advance each sampler will be recorded. Samples will be described per USCS criteria with additional observations noted as necessary (depth to water, obstructions to drilling, debris encountered, etc.). Boreholes will be abandoned using bentonite pellets hydrated in 12 inch lifts. Soil generated from each boring will be used as backfill material in the upper 24 inch of each boring to allow for surface restoration. All pertinent data will be summarized in a geotechnical report.

The location selected for the geotechnical borings have been located outside of the boring alignment to eliminate the potential for loss of drilling fluids into the abandoned borehole during pipe installation.

Data from this investigation will be used during preparation of the pipe installation plan which will satisfy the requirements of Nassau County for work within their Right of Way (ROW). The geotechnical investigation report, design drawings, and permit application will be submitted to CDM Smith for review prior to submittal to Nassau County for approval of work within the ROW.

3.2 Mobilization

Project start-up will include procurement activities followed by mobilization of personnel and equipment to the site. Arrowhead will mobilize field personnel from our Lenexa, Kansas and Des Moines, Iowa offices in time for a pre-construction meeting as required by CDM Smith. Specific activities that will be completed by Arrowhead during this time are listed below.

- Project trailer for CDM Smith personnel and storage facilities will be set-up in the support area.
- Portable toilet units and hand-wash facilities will be provided for Arrowhead, CDM Smith, and subcontractor personnel use.
- As appropriate, silt fencing will be placed down gradient of construction areas, and run-on controls (hay bales, berms, etc.) will be placed up gradient. Refer to the Soil Erosion and Sediment Control Plan for specifics related to storm water protection. All work will be performed in compliance with Section 2370.
- High-visibility construction fencing will be erected as needed. Construction fencing will be field-adjusted as work progresses
- Roll-off containers for general waste disposal will be delivered

3.3 Site Preparation

Prior to the commencement of any construction activities, Arrowhead will contact New York Dig-Net to obtain a utility clearance and to mark public utilities on public property. Additionally, a private utility locator will confirm the markings placed by One-Call participants using geophysical methods and will mark utilities on private property in the work areas. Documentation of the utility survey and its results will be completed prior to any subsurface activities being performed. Known utilities identified adjacent to the work area will be clearly marked and identified. Arrowhead will place construction safety fencing around utilities and other structures to be protected during work.

Site preparation will also include clearing and grubbing of vegetation within work areas and removing concrete/asphalt as necessary to allow construction. Cleared vegetation will be shipped offsite for recycling at a local landscape recycling facility.

3.3.1 *Pre-Construction Video Survey*

Arrowhead will complete a pre-work video survey of all work areas, roads, and other site features prior to beginning any work activities. The purpose of this video survey is to document existing site conditions, in particular the conditions of any damaged areas of roadways or buildings. A DVD copy of the video will be submitted to CDM Smith as part of the project record documents. All photography will be completed in compliance with Specification section 1380.

3.3.2 *Erosion and Dust Control*

Arrowhead will install and maintain soil erosion and dust control measures for the duration of the construction activities. Refer to the Soil Erosion and Sediment Control Plan and Environmental Protection Plan for details regarding the location and type of erosion control measures and a discussion of the dust control measures to be implemented during each phase of the project. All work will be completed in compliance with Section 2370.

3.3.3 *Land Surveying*

A State of New York licensed land surveyor will stake out the locations of all project components (i.e. pipe alignment) prior to construction. The surveyor will also provide construction bench marks as needed during construction. The surveyor will also complete as-built surveying for use in preparing the Record Shop Drawings. As-built surveying will include the location of new yard piping, locations of cleanouts and handholes, the location and elevation of new extraction well vaults and well casing.

The conveyance piping top of pipe elevations installed using open cut methods will be collected by field crews on a daily basis, with all measurements taken with respect to construction bench marks installed by the project land surveyor.

3.3.4 *Decontamination*

This task includes the decontamination of sampling equipment used to collect samples for chemical analysis, and personal decontamination upon leaving the exclusion zone. Decontamination is discussed in more detail in the Site Safety and Health Plan and Environmental Protection Plan. Field procedures for decontamination are found in the Worksheet 17m of the QAPP. In general, equipment decontamination will consist of an Alconox wash with clean water rinse.

3.4 Utility Installation

Expansion activities outside of the GWTF will include installation of new extraction well vaults, installation of approximately 2,000 linear feet of influent groundwater piping, installation of new effluent piping, installation of a remote control panel, electrical service installation, and construction of chain link fencing.

3.4.1 Earthwork

This task includes grading, excavating, and trenching plus characterizing imported material and excess excavated soil for offsite disposal. Earthwork is necessary for a variety of the tasks in this project including yard piping installation (including directional drilling and open cut), electrical site work, pavement restoration, seeding, and well vault installation.

Grading and excavation will be conducted at the locations indicated on the GWTF shop drawings and in accordance with the Specifications and EPP.

Importation of fill material is not anticipated, but if necessary the following procedure will be used. Fill material imported to the site must be sampled to determine if the soil is clean and can be used for backfill. Only soil that will allow for a site cleanup objective of Unrestricted Use will be allowed for importation. A soil sample for sieve analysis will be collected for every 3,000 cubic yards. Refer to the project specifications for grain size requirements based on use of material. Additionally, one soil sample will be collected for every 5,000 cubic yards of imported material and sampled for the following:

- Target Compound List (TCL) VOCs
- Target Analyte List (TAL) metals including mercury
- TCL SVOCs
- Polychlorinated biphenyls (PCBs)
- Cyanide
- Pesticides including parathion
- Herbicides (2,4,5-T, 2,4-D, and Silvex)

Dust control, erosion control, and sediment control are discussed in the Section 4.0 of this document, the Environmental Protection Plan, and in Section 02370 of the specifications.

Sampling and analytical requirements of imported soil and characterization of excess excavated soil are discussed in Section 02300 of the specifications and Worksheet #18 of the QAPP. Analytical data from backfill samples will be compared to QAPP Table 15, which is based on NYSDEC Recommended Soil Cleanup Objective Technical and Administrative Guidance Manual #4046, and submitted to CDM Smith for approval prior to use.

3.4.2 *Electrical Site Work*

This task includes installing an electrical service line to the south well field. This task does not include electrical connections inside the treatment building. All work will be conducted in accordance with specification Sections 16000, 16191, 16375, and 16600. The locations of primary and secondary service lines are indicated on the GWTF design drawings. This work includes:

- Installation and testing all underground electric service lines.
- Providing meter and transformer
- Providing electrical service to extraction wells

Work from the electrical service connection point to the new pad mounted transformer will be completed by the utility provider. Arrowhead will be responsible for terminations within the transformer cabinet and installation of the secondary feeder. All work conducted by Arrowhead will be completed prior to energizing the service.

3.4.3 *Pavement Restoration*

This task includes restoring sub-grade and pavement disturbed during trenching to the satisfaction of the Contracting Officer, in accordance with Section 02576, and Details C and D included on drawing C-7.

3.4.4 *Seeding*

After construction, disturbed areas will be restored by establishing turf in accordance with Section 2900. The soil will be tilled to a minimum depth of 4 inches and the appropriate seed will be applied using broadcast seeding

3.4.5 *GWTF Extraction Well Vaults*

This task includes installation of the well vaults in accordance with the specifications. Specifications for the concrete well vault and vault access door are found in Section 03410. Specifications for all of the pipe, valves, fittings, and couplings are found in Section 13319 Refer to the GWTF design drawings for vault construction details. Specifications for the control system components such as level transducer, gauges, and electrical controls are found in Section 16191. Refer to the GWTF design drawings for vault construction details.

3.4.6 Chain Link Fencing

Chain link fencing will be installed surrounding the new extraction wellhead and local control panel as indicated on drawing C-5. To provide additional security, privacy screening will be installed.

Additionally, several sections of fencing located near the GWTF will be temporarily removed to allow for installation of new influent and effluent piping. Following pipe installation and backfill placement the fabric will be reinstalled using existing posts, bracing, and misc. brackets.

3.5 GWTF Startup

3.5.1 GWTF Process Equipment

Upgrades to process equipment will include removal and installation of the air stripper blower, liquid transfer pumps, the addition of one bag filter unit, the addition of 3 trays to the air stripper along with modification to the electrical distribution equipment and process control equipment. The upgraded treatment system will be designed to operate at up to 500gpm. All equipment has been designed in compliance with specification Section 13300.

The air stripper system will be capable of reducing VOC concentrations in water to levels at or below the New York State Department of Environmental Conservation (NYSDEC) State Pollutant Discharge Elimination System (SPDES) permit equivalent. Air VOC concentrations are monitored as part of the routine O&M sampling, with discharge levels monitored to insure they are below state discharge criteria. Details to be included in the GWTF shop drawings include air stripper efficiency calculations, and manufacturer's product information.

The control system of the GWTF currently consists of a computer-based monitoring and control system including a Programmable Logic Controller (PLC) for process interface and data acquisition, auto-dialer that initiates PLC-initiated communications, dial-in capabilities to allow remote operations, and uninterruptible power supply.

The PLC and associated control units control or monitor the following functions at the GWTF:

- Extraction wells
- Transfer pumps
- Bag filter system
- Caustic chemical feed system for pH control
- Air stripper treatment system
- Effluent discharge at the recharge basin

Existing control equipment will remain in place with addition of a remote control panel at the southern well field. Communication between the control panels will be completed via fiber optic cable.

Motor control within the existing plant is completed by the Motor Control Center (MCC), as part of the plant upgrades the existing variable frequency drives (VFD's) will be removed and components sized for the larger transfer pumps and blower will be installed. A significant portion of the existing MCC cabinet and wiring will remain in place.

3.5.2 GWTF System Startup Testing

This task includes conducting the Initial Testing Program (ITP), a 14-day operational test aimed at demonstrating long-term operability of the system while confirming performance expectations with regard to the contaminant removal. Testing during the ITP will be performed using groundwater produced from the new (southern) extraction well field and combined flow from both well fields. During these performance tests, it will be demonstrated that the quality of the effluent from the groundwater treatment system does not exceed the limits required by the NYSDEC SPDES permit equivalent and Air Pollution Control permit equivalent. Specifications for completing the ITP are found in Section 01800, Paragraph 3.2.

The tasks included in the ITP are performed to ensure that all groundwater treatment equipment, instrumentation, controls, and telemetry are functioning properly as designed and installed. Items included are:

- Level transducers in the monitoring wells during startup testing for continuous water level measurements
- Vendor services required during start-up testing
- Operations and Maintenance (O&M) manual
- Collection, packaging and shipping samples to the laboratory for analysis
- Startup testing reporting

Samples will be collected during the ITP to verify that the system is meeting the requirements of the NYSDEC SPDES permit equivalent and Air Pollution Control permit equivalent. A summary of the required samples is included in the QAPP Worksheet #17g and Worksheet #18. Sampling during startup includes water level measurements, water samples, and air samples.

3.6 Transportation and Disposal of Waste

Transportation and disposal (T&D) of waste will be conducted in accordance with Section 2120 and is discussed in detail in the Environmental Protection Plan.

4.0 Trenching and Backfill

This section presents the Trenching and Backfill Plan (TBP) for earthwork activities associated with construction of the GWTF. The following describes the procedures that will be implemented by Arrowhead and its subcontractors to ensure that excavation, trenching, and backfilling activities are performed according to the subcontract specifications. Accordingly, this is in accordance with Sections 02100 (Site Preparation) and 02300 (Earthwork) of the subcontract specifications.

Arrowhead's general scope-of-work (SOW) with respect to excavation, backfilling, and other earthwork include:

- Trenching and backfilling associated with the installation of influent and effluent yard piping and site utilities.
- Excavation of access pits to allow installation of influent piping and conduits under Stewart Avenue.
- Directional boring under Stewart Avenue
- Excavation for construction of extraction well vaults.
- General, site-wide grading.

Specific elements of the SOW are listed below.

- Excavation and trenching of sufficient depth and width to accommodate yard piping, and well vaults.
- Pothole excavation to confirm utility line location during directional drilling
- Bedding all yard piping installed by open cut with clean sand bedding, or compacted native soil if suitable
- Backfill with compacted recycled concrete aggregate (RCA) beneath concrete and asphalt pavement.
- Backfill with crushed stone beneath structures.
- Backfill with structural fill (compacted), as required, around structures
- Backfill with excavated material in areas where pavement is not present.
- Placement of topsoil in areas where pavement is not present
- In-place density testing by a local geotechnical testing service.
- Standard Proctor testing (ASTM D 698), Modified Proctor testing (ASTM D 1557), and sieve analyses (ASTM D 422) by a local geotechnical testing service. A minimum of one test per 3,000 cubic yard (CY) shall be performed, but no less than one test per borrow area.
- Sieve analyses (ASTM D 422) by a local geotechnical testing service. A minimum of one test per 3,000 CY shall be performed.
- Chemical testing of all imported soil by an off-site laboratory. Refer to QAPP Table 30 for analytical testing requirements.

4.1 General Considerations

Excavations and backfill placement will conform to the dimensions and elevations shown on approved design drawings. Excavation below the indicated depths will not be permitted except to remove unsatisfactory material. The following text discusses general considerations associated with excavation, trenching, and backfill work.

4.2 Planning

Prior to beginning any excavation, underground installations (e.g. sewers, telephone, water, electric lines, and natural gas lines) will be located and protected from damage or displacement. Utility companies (via the “New York Dig-Net” system) will be contacted to locate and mark the locations of public underground utilities. Additionally, a private utility locator will confirm the markings placed by One-Call participants and will mark utilities on private property in the work areas. A completed utility clearance form will be submitted to CDM Smith for each excavation area prior to intrusive activities at that area (refer to Section 5.13 of the SSHP).

4.3 Excavation Boundary Staking/Marking

Prior to opening an excavation, the area will be staked or otherwise marked (with spray paint) to indicate the anticipated trench alignment or boundary of the excavation. Excavation boundary staking/marketing will be based upon the design drawings and be reviewed by the Site Supervisor prior to commencement of activities. Trench boundaries and alignment may be adjusted in the field to avoid utilities and other obstructions.

4.4 Vegetation Protection

Vegetation designated to remain (as designated by the CDM Smith Construction Supervisor) will be protected from damage during activities by erection of suitable barriers, guards and enclosures, or by other approved methods.

4.5 Excavation Requirements

All excavations must meet the Occupational Safety and Health Administration (OSHA) safety requirements found in 29 Code of Federal Regulations (CFR) 1926.650 – 652 (Subpart P). For this project, trenches and other excavations are not expected to penetrate greater than 8 feet below ground surface (bgs). Therefore, sloping or other approved support systems will be applicable as OSHA-required protective systems. Based on the developed nature of the site, it is anticipated excavated soils will be Type C. In accordance with OSHA Standards, Type C soils require a 1.5:1 (H:V) slope.

Competent Person

In accordance with 29 CFR 1926.650, daily inspections of the open excavation will be made by a Competent Person. Arrowhead's Site Supervisor, Joe Cotter, will serve as the Competent Person for this purpose. Daily inspections of the excavation and the adjacent areas shall be made by the Competent Person for evidence of a situation that could result in possible cave-ins, hazardous atmospheres, or other hazardous conditions. The inspection shall be documented (refer to the attached Trench/Excavation Inspection Checklist) prior to the start of work and as needed during the work. When personnel are required to enter the trenches, inspections shall also be made after rain storms or other conditions that may increase the chance of hazards occurring.

As a general rule, all spoils shall be placed at least 2 feet from the edge of the excavation. This distance may be increased at the discretion of the competent person. Appropriate barriers will be placed at the edge of open excavations as required to maintain safe conditions. The barriers shall be placed no closer than 6 feet from the edge of the excavation.

4.6 Excavation Inspection and Testing

A competent person will inspect the excavation and adjacent areas as follows:

- Daily, prior to starting work
- Periodically throughout the work day
- After every rainstorm
- After any other occurrence that potentially contributes to trench instability.

The daily trench inspection shall be documented using the form provided in Appendix A of the SSHP. If evidence of a situation which could result in possible cave-ins, slides, failure of protective systems (if applicable), hazardous atmospheres, or other hazardous conditions are identified, exposed workers will be removed from the hazard and all work in the excavation will be stopped until all necessary safety precautions have been implemented. In locations where oxygen deficient or gaseous conditions are known or suspected, air in the excavation will be tested prior to the start of each shift or more often if directed by the designated authority. A log of all test results will be maintained at the job site.

4.7 Directional Boring

Installation of influent groundwater conveyance piping and communication conduit under Stewart Avenue will be completed using directional boring methods. Refer to Figure 3-1 for the bore alignment and location of access pits. Directional boring will be completed in accordance with the approved boring plan, with work in general proceeding as follows:

- Completion of geotechnical borings at either end of boring to confirm suitability of soil

- Preparation of a boring plan for review by CDM Smith and Nassau County Department of Public Works
- Permit issuance by Nassau County Department of Public Works
- Prior to boring location of all utilities within bore alignment
- Excavation of access pits
- Fusion of HDPE piping, including air leak test
- Opening of bore
- Installation of influent groundwater piping and communication conduit
- Connection of piping to previously installed work
- Placement and compaction of backfill material
- Hydrostatic pressure testing of influent groundwater piping
- Site restoration

4.8 Water Management

All excavation and trench work will be performed in dry conditions. Temporary dewatering and drainage systems will be implemented as necessary to facilitate dry work conditions. To prevent surface water from entering excavations during rain events, dikes, ditches, and/or berms will be constructed. Soil types at the site consist of well draining sand; based on previous site experience very little to no accumulation of standing water will develop in open excavation during normal rainfall events. In the event of significant rainfall that creates standing water, the water will be allowed to infiltrate into the soil prior to placement of pipe or backfill material. The QC Officer will stop work if conditions are not acceptable for installation of piping or placement of backfill material.

4.9 Soil Testing

Soils testing shall be performed by an approved commercial testing laboratory. Arrowhead will submit the licenses or certifications of qualifications for the performance of field and laboratory testing to the CDM Smith Construction Supervisor for approval. Soil testing requirements are listed below.

- Sieve Analysis – Sieve analysis shall be performed in accordance with ASTM D 421 and ASTM D 422. A minimum retest for classification shall be performed every 3,000 cubic yards.
- Standard and Modified Proctor Test – A moisture-density relationship for the soil shall be determined in accordance with ASTM D 698 (Standard Proctor) or ASTM D 1557 (Modified Proctor), as specified. A minimum of one test per 3,000 cubic yards shall be performed, but no less than one test per borrow area. The Engineer may direct additional tests should soil materials change during the course of work.
- Density Testing – Field in place density tests shall be determined in accordance with ASTM D 2922. Structural fill shall be compacted at 95% maximum density (Modified Proctor, ASTM 1557) and common and select fill shall be compacted at 90% maximum density (Standard Proctor), within minus 2 and plus 3 of optimum moisture. A minimum of one test shall be performed per 200 feet of backfilled trench, with no less than one test per lift. Calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922. ASTM

D 2922 results in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the in place moisture content of soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of each working day and for each different type of material encountered. Calibration for in-place density testing shall be performed in accordance with ASTM D 1556.

- Chemical Testing - All materials brought onsite to be used as fill and topsoil will be certified clean and tested to ensure they are free from chemical contamination by an offsite laboratory. Refer to QAPP Table 30 for a list of analytical testing requirements.

4.10 Specified Backfill Type

The following are the specified backfill types for the project:

COMMON BACKFILL

Sieve Size Percent Finer by Weight:

2-in	100
1-in	80-100
3/8-in	70-100
No. 30	50-100
No. 60	15-65
No. 200	0-20

STRUCTURAL BACKFILL

Sieve Size Percent Finer by Weight:

2-in	100
No. 4	20-70
No. 40	5-40
No. 200	0-20

CRUSHED STONE

Crushed stone shall be No. 57 stone unless otherwise specified. Crushed stone shall be sound, hard, durable and shall meet the following gradation requirements and conform to ASTM C33 Size No. 57.

Sieve Size Percent Finer by Weight:

1-1/2-in	100
1-in	95-100
1/2-in	25-60
No. 4	0-10
No. 8	0-5

PIPE BEDDING

Excavated material will be used for pipe bedding unless found unsuitable based on inspection by the Site Supervisor, CDM Smith field representative and the QC officer. If found unsuitable, imported sand will be used to bed pipe. Imported sand shall meet the following gradation requirements:

Sieve Size:	Percent Passing
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

SELECT FILL

The select fill shall meet the requirements of common fill specified above except the maximum diameter shall be 3/4 inch.

TOPSOIL

Topsoil shall meet the requirements of NYSDOTSS 713 and ASTM D 5268. Topsoil material shall not contain slag, cinders, stones, lumps, roots, plant parts, trash, or similar objects larger than 1.5-inch in any dimension and shall have a pH of 5.8 to 7.6. Topsoil material shall have a minimum organic content of 2.75 percent by weight. Imported topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Certificates of compliance for the above parameters shall be provided from the source facility and submitted to the Contracting Officer. If certificates are not available for any parameter, the Contractor shall be responsible for providing soil testing to determine the material. The testing shall determine whether any soil amendments are required to meet the growing requirements of landscaping features to be used.

4.11 Site Preparation

Grassed areas will be prepared by stripping topsoil from areas to be occupied by the treatment buildings, yard piping, structures, and other areas to be excavated. Stripped topsoil will be free of brush, trash, large stones and other extraneous material. Efforts will be made to not mix topsoil and subsoil during the

stripping operation. Topsoil that is suitable for re-use will be stockpiled and protected until it is used during site restoration operations.

Timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish, and other objectionable material resting on or protruding through the surface of the ground shall be removed to the extent required to complete construction activities. Arrowhead shall grub and remove stumps, roots in excess of 1 ½-inches in diameter, matted roots, brush, timber, logs, concrete rubble, and other debris encountered to a depth of 18 inches below original grade, or 18 inches beneath the bottom of foundations, whichever is deeper. Grubbing holes and depressions excavated below the original ground surface shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface in accordance with Sections 3.5 and 4.2.

Prior to trenching in paved areas, the trench limits will be spray-painted on the pavement surface. The pavement will then be cut along straight lines using a walk-behind concrete saw (electric or gas-powered). Following saw-cutting, the pavement will be broken into manageable pieces using a jack-hammer, chisel, or equivalent equipment. Alternately, the pavement may be pulverized using an excavator or back-hoe with a hydraulic hammer attachment. Concrete rubble will be collected for disposal as Construction and Demolition (C&D) debris in accordance with the Environmental Protection Plan (EPP). Asphalt rubble will be collected and recycled as specified in Section 2100, Paragraph 3.5.

Surplus topsoil, clearing and grubbing debris, and pavement debris will be disposed in accordance with the EPP after all work is completed, unless otherwise directed by the CDM Smith Construction Supervisor.

4.12 Excavation

Trenches will be excavated to the depth indicated on the design drawings and in widths sufficient for laying the pipe and proving stable soil conditions. The bottom of the excavations will be firm and dry. Trench width will be kept to a practical minimum.

The trench will be accomplished by methods that preserve the undisturbed state of the sub-grade soils. The trench will be excavated by machinery to the designated sub-grade. Sub-grade soils that become loose, soft, “quick” or otherwise unsatisfactory will be removed and replaced as directed by the CDM Smith Construction Supervisor.

Rocks or debris encountered on the floor of the pipe trench will be removed to ensure a level surface for placing the pipe. If necessary, over-excavation will be performed. Voids or depressions from over-excavation will be filled (with Select Fill) and compacted to the required trench floor elevation.

Excavated materials will be stockpiled on the trench bank, minimum of 2 feet from the excavation limits. Excavated materials will be segregated for use as trench backfill (bedding sand), if suitable. Should conditions make it impractical or unsafe to stockpile excavated material adjacent to the trench; the material will be hauled and stockpiled at a location approved by the CDM Smith Construction Supervisor. No excavated material will be removed from the site of the work or disposed, except as directed by the CDM Smith Construction Supervisor, pursuant to the EPP.

Excavation of test pits may be performed for determining the location of underground utilities or structures as an aid in establishing the precise location of new work. Test pits will be backfilled immediately upon obtaining the desired information with the backfilled surface being maintained in a satisfactory condition for travel until resurfaced.

Excavation of the soil in the building foundation area shall be accomplished by a hydraulic excavator. The excavation width will be sufficient to accommodate personnel to set concrete forms, install reinforcement, and place concrete in a safe manner. Excavated material will be hauled and stockpiled at a location on site approved by the CDM Smith Construction Supervisor. No excavated material will be removed from the site of the work or disposed, except as directed by the CDM Smith Construction Supervisor, pursuant to the EPP.

4.13 Support System Design

As discussed previously, the sides of excavations will be sloped at 1.5:1 or benched for slope stability in trenches or other excavations deeper than 4 feet. Sloping will also be employed in shallower excavations if soil conditions appear unstable or for any other reason as determined by the Competent Person. If for any reason that sloping of the trench excavation is not permissible, then the excavation will proceed with the aid of a trench box.

4.14 Structural Excavation Procedures

Excavations will be suitably wide for construction of structures, including excavation supports (if necessary) and working clearances. Excavation will be performed in-the-dry and will be accomplished by methods that preserve the undisturbed state of sub-grade soils. As necessary, drainage and dewatering systems shall be in place and operational prior to beginning excavation work. In no case will the earth be plowed, scraped or excavated by any means so near to the finished sub-grade that would disturb the

finished sub-grade. Hand excavation of the final 3 to 6 inches may be performed to obtain a satisfactory, undisturbed sub-grade. Sub-grade soils that become soft, loose, “quick”, or otherwise unsatisfactory for support of structures as a result of inadequate excavation or other construction methods will be removed and replaced with lean concrete, crushed stone, or other structural fill, subject to the prior approval of the CDM Smith Construction Supervisor.

Fill required beneath slabs on grade will be crushed stone. Fill and backfill material placed immediately adjacent to structures will be an approved structural fill material. All structure water-tightness testing and damp-proofing/waterproofing will be completed prior to placement of fill and backfill around structures. Structural fill will be placed and compacted in even lifts of 6-inches (compacted thickness) uniformly around the structure and under and over pipes connected to the structure.

The sub-grade for all structures will be prepared as follows:

- The sub-grade will be compacted to a minimum of 95 percent Standard Proctor (ASTM D 1557).
- Where the existing sub-grade contains a significant amount of clay or cohesive soils, or if sub-grade compaction criteria cannot be achieved, over excavation of the soils below the structure will be conducted for the placement of 6 inches of crushed stone or a lean concrete working mat. Prior to placement of the crushed stone layer or lean concrete working mat, the top 12-inches of the existing sub-grade shall be compacted in an attempt to achieve a minimum of 95 percent Standard Proctor (ASTM D 1557).

When excavations have reached the required sub-grade, including any allowances for over excavation, soils testing will verify the suitability of the existing sub-grade soils for the anticipated foundation and structural loadings. If the existing sub-grade soils are determined to be unsuitable, direction will be provided by the CDM Smith Construction Supervisor regarding over excavation and replacement with suitable materials. Over excavated soils will be replaced by lean concrete, crushed stone, or other structural fill subject to prior approval of the CDM Smith Construction Supervisor.

4.15 Directional Boring

Directional boring will be used to complete installation of a groundwater conveyance pipe and communication conduit under Stewart Avenue. The location of the directional bore is shown on Figure 3-1. As part of the directional bore an access pit will be excavated at either end of the bore alignment. Following completion of pipe installation the access pits will be backfilled and the site will be restored to match conditions prior to work. Directional boring will be completed by the same subcontractor responsible for installation of all yard piping installed by open-cut method.

4.16 Backfilling Procedures for Common and Select Fill

Backfill materials will be placed in lifts to suit the specified compaction requirements to the lines and grade required, making allowances for settlement and placement of cover materials (pavement and topsoil). Backfill will be placed in lifts not exceeding 6 inches loose thickness for compaction by hand-operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise approved by the CDM Smith Construction Supervisor.

Design Drawing C-07, details C and D, depict typical trench cross-sections. Select Fill shall be placed a minimum of 6 inches below to 12 inches above the pipe. The remainder of the trench from the surface of the Select Fill to the ground surface shall be backfilled with common fill.

As soon as practical after piping has been laid, jointed, and tested, backfilling shall begin and thereafter be implemented expeditiously. Trenches shall be backfilled to the grade shown on the Contract drawings. Barricades and/or flagging tape will be placed along section of open trench left in place over night. Select fill under, around, and above the pipe will be placed concurrently to the pipe placement. The process of trenching, pipe installation, and completion of backfill will be repeated iteratively until all yard piping has been successfully installed.

Backfill will be brought up evenly on all sides of the piping. Each layer of backfill material will be thoroughly compacted by rolling, tamping or vibrating with mechanical compacting equipment or hand tamping. If rolling is employed, a suitable roller or tractor will be used, being careful to compact the fill throughout the full width of the trench.

To prevent longitudinal movement of the pipe, dumping backfill material into the trench and then spreading will not be permitted until selected material or bedding sand has been placed and compacted to a minimum level of 6 inches over the pipe.

4.17 Backfill and Compaction of Structural Fill

Compaction in open areas may be accomplished by any of the following methods: compaction equipment, fully loaded 10-wheel trucks, tractor bulldozers weighing at least 30,000 pounds and operated at full speed, or heavy vibratory rollers. Compaction in confined areas (including areas within a 45 degree angle extending upward or downward from the base of a wall) and in areas where the use of large equipment is impractical, will be accomplished by hand-operated vibratory equipment or mechanical tampers (tools weighing at least 20 lbs). Lift thickness will not exceed 6-inches (loose thickness) when hand-operated equipment is used. If necessary, controlled quantities of water will be added during compaction to achieve optimum moisture content.

4.18 Grading

All filled areas shall be smoothed and graded to provide a finished surface that is reasonably smooth, compacted to the specified project requirements, free from irregular surface changes, and sloped to drain properly. Grading shall be performed to the lines and grades to match pre-existing conditions, unless otherwise shown on approved design drawings. Grading shall not create swales or areas where ponding of water will occur.

Grading will be performed to ensure a level surface for the foundation of each treatment building and equipment pad. Sub-grades will be completely and continuously drained throughout the grading process. As necessary, temporary drains, drainage ditches, etc., will be installed to intercept or divert surface water that may affect the execution or condition of the grading work.

If at the time of grading it is not possible to place any material in its proper section of the work, the material will be stockpiled in an approved area for later usage.

Stone and rock fragments larger than 4-inches in their greatest dimension will be removed from within the top 6-inches of the finished grade of fills and embankments.

All loose or protruding rocks in slopes of cut areas will be removed to line or finish grade of the slope. All cut and fill slopes will be uniformly dressed to the slope, cross-section, and alignment shown on approved design drawings.

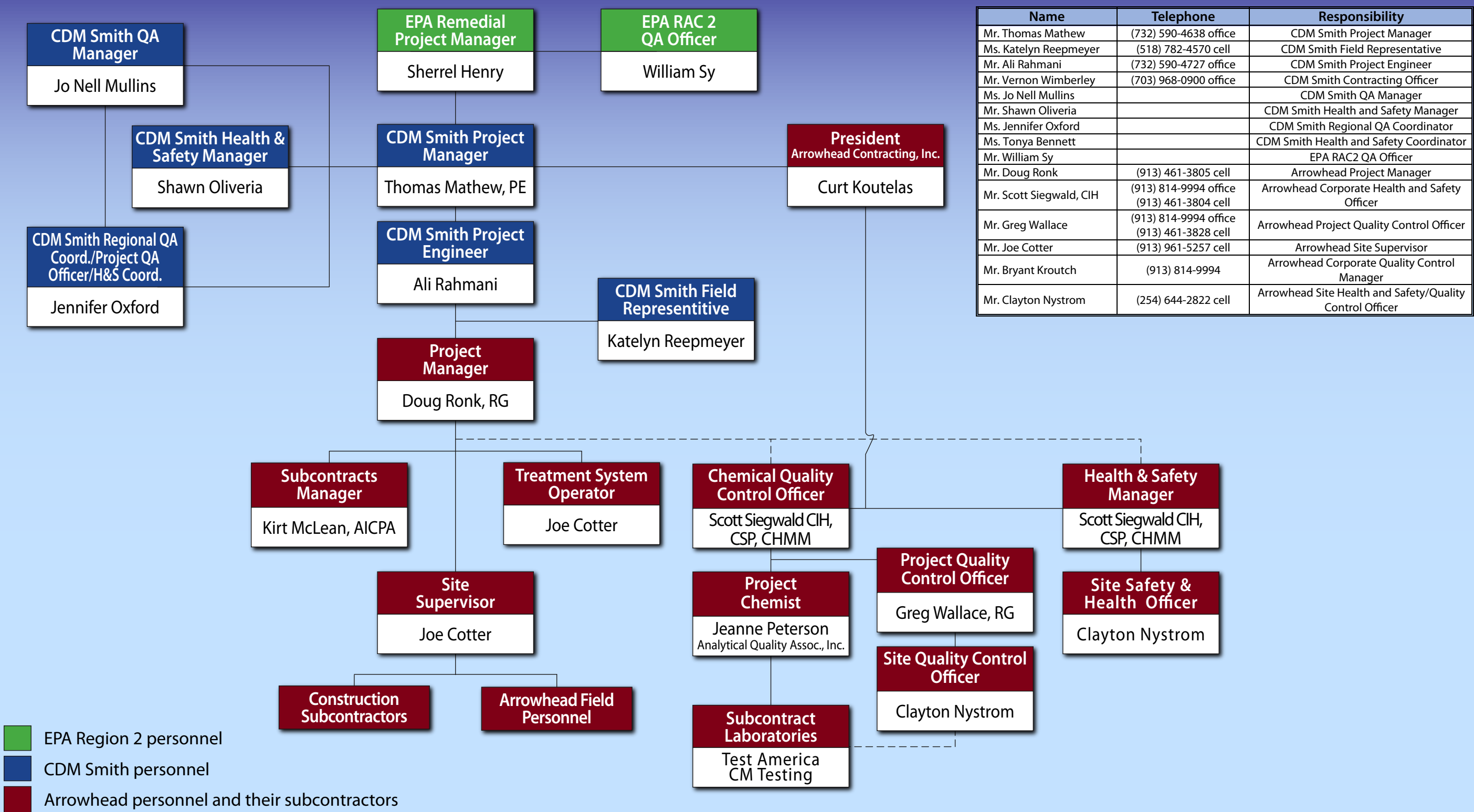
Tables

Table 2-1
Project Personnel and Responsibilities

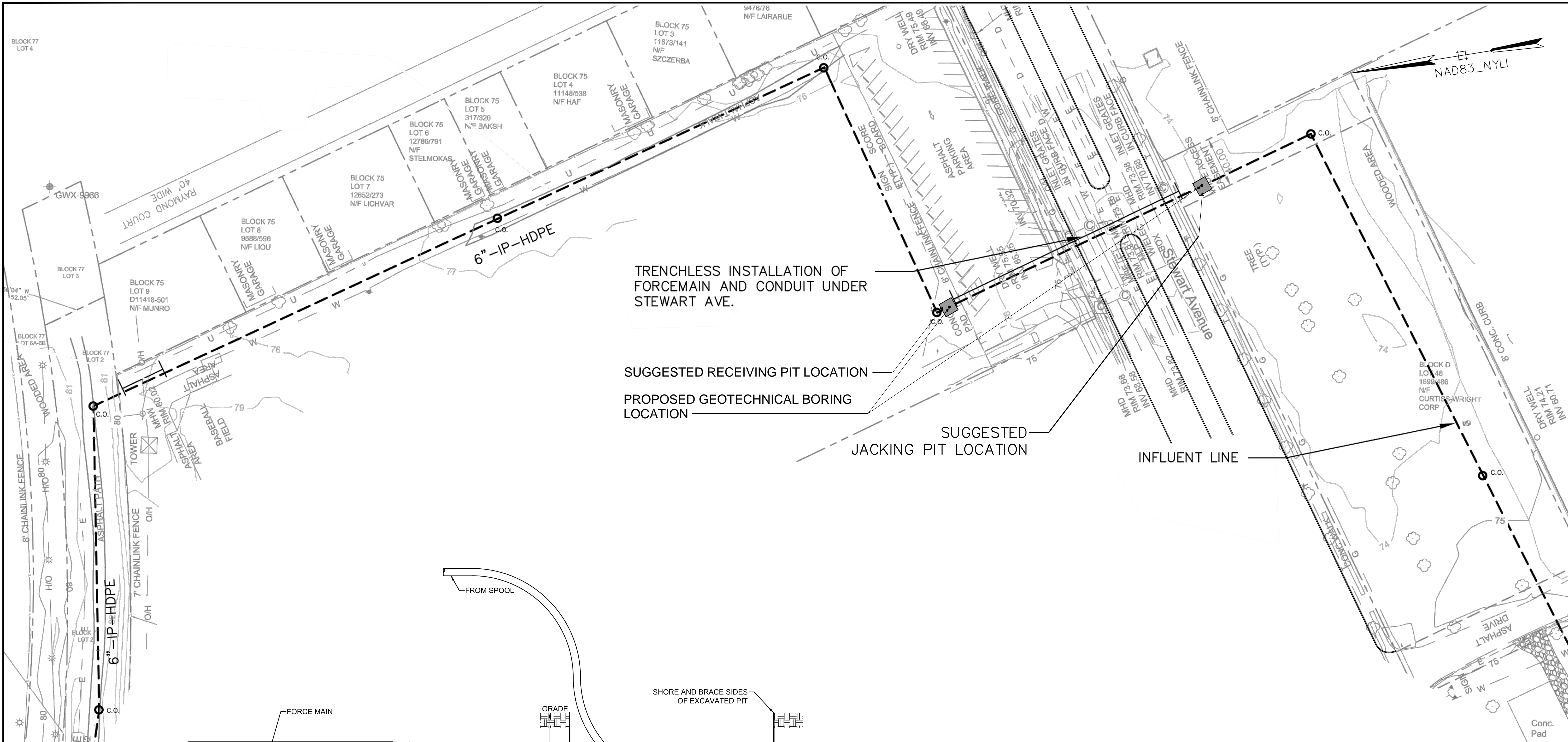
Name	Telephone Number(s)	Responsibility
Mr. Thomas Mathew	(732) 590-4638 office	CDM Smith Project Manager
Ms. Katelyn Reepmeyer	(518) 782-4570 cell	CDM Smith Field Representative
Mr. Ali Rahmani	(732) 590-4727 office	CDM Smith Project Engineer
Mr. Vernon Wimberley	(703) 968-0900 office	CDM Smith Contracting Officer
Ms. Jo Nell Mullins		CDM Smith QA Manager
Mr. Shawn Oliveria		CDM Smith Health and Safety Manager
Ms. Jennifer Oxford		CDM Smith Regional QA Coordinator
Ms. Tonya Bennett		CDM Smith Health and Safety Coordinator
Mr. William Sy		EPA RAC2 QA Officer
Mr. Doug Ronk	(913) 461-3805 cell	Arrowhead Project Manager
Mr. Scott Siegwald, CIH	(913) 814-9994 office (913) 461-3804 cell	Arrowhead Corporate Health and Safety Officer
Mr. Greg Wallace	(913) 814-9994 office (913) 461-3828 cell	Arrowhead Project Quality Control Officer
Mr. Joe Cotter	(913) 961-5257 cell	Arrowhead Site Supervisor
Mr. Bryant Kroutch	(913) 814-9994	Arrowhead Corporate Quality Control Manager
Mr. Clayton Nystrom	(254) 644-2822 cell	Arrowhead Site Health and Safety/Quality Control Officer

Figures

Figure 2-1 Project Organization Chart - Old Roosevelt Field Superfund Site - RA Construction



Name	Telephone	Responsibility
Mr. Thomas Mathew	(732) 590-4638 office	CDM Smith Project Manager
Ms. Katelyn Reepmeyer	(518) 782-4570 cell	CDM Smith Field Representative
Mr. Ali Rahmani	(732) 590-4727 office	CDM Smith Project Engineer
Mr. Vernon Wimberley	(703) 968-0900 office	CDM Smith Contracting Officer
Ms. Jo Nell Mullins		CDM Smith QA Manager
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Mr. Joe Cotter	(913) 961-5257 cell	Arrowhead Site Supervisor
Mr. Bryant Kroutch	(913) 814-9994	Arrowhead Corporate Quality Control Manager
Mr. Clayton Nystrom	(254) 644-2822 cell	Arrowhead Site Health and Safety/Quality Control Officer



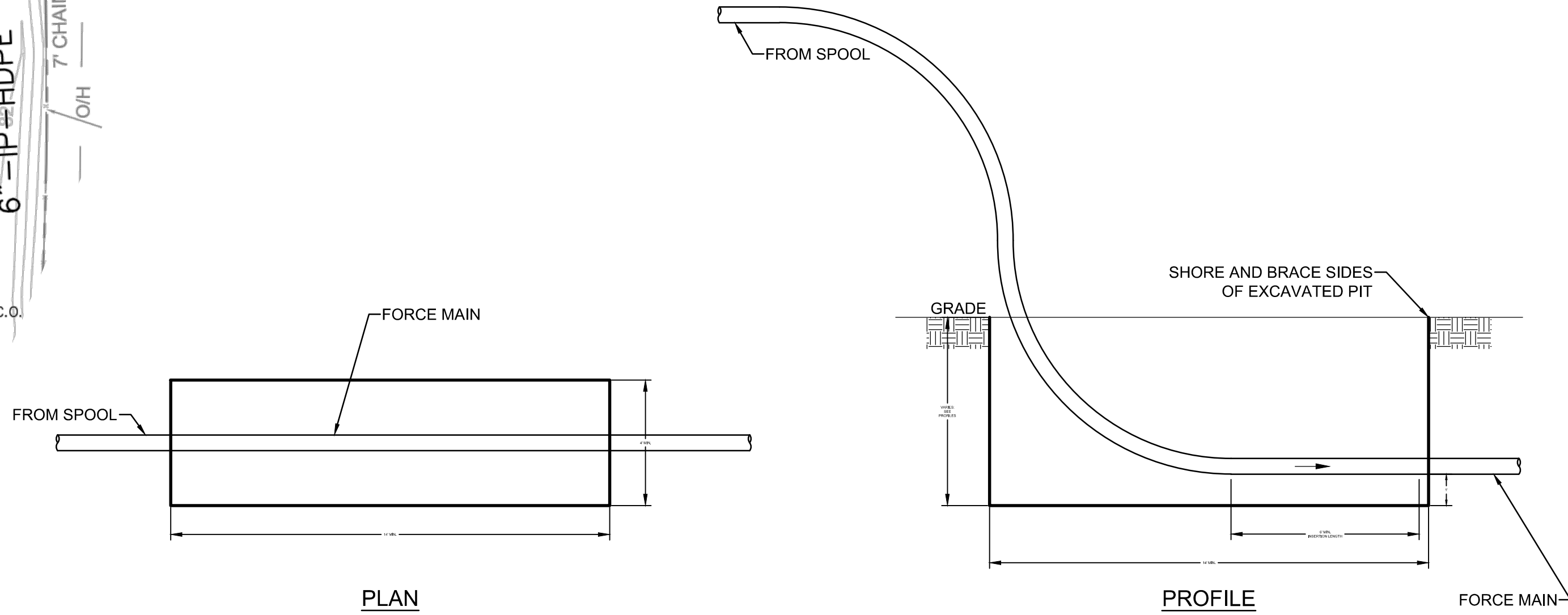
TRENCHLESS INSTALLATION OF
FORCEMAIN AND CONDUIT UNDER
STEWART AVE.

SUGGESTED RECEIVING PIT LOCATION

PROPOSED GEOTECHNICAL BORING
LOCATION

SUGGESTED
JACKING PIT LOCATION

INFLUENT LINE



INSERTION PIT DETAILS

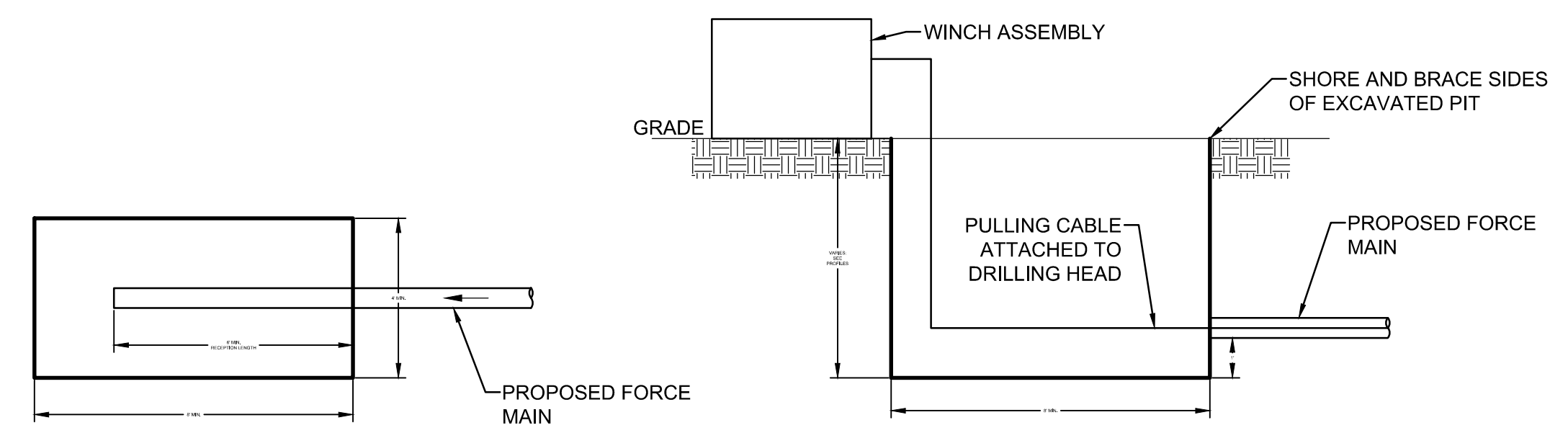
N.T.S.

NOTES:

1. INSERTION AND RECEIVING PITS SHALL BE STRATEGICALLY LOCATED ALONG THE ALIGNMENT OF THE PIPE TO MINIMIZE THE QUANTITY OF PITS.
2. PITS SHALL BE KEPT AS DRY AS POSSIBLE AND SHALL BE EXCAVATED AT LEAST ONE FOOT BELOW THE PIPE INVERT TO MINIMIZE THE POTENTIAL FOR CONTAMINATION DURING INSTALLATION OF THE PROPOSED FORCE MAIN, VALVES AND FITTINGS
3. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CHECK WITH THE VARIOUS UTILITY COMPANIES AND DETERMINE THE LOCATION OF EXISTING UTILITIES IN THE VICINITY OF THE WORK AREA

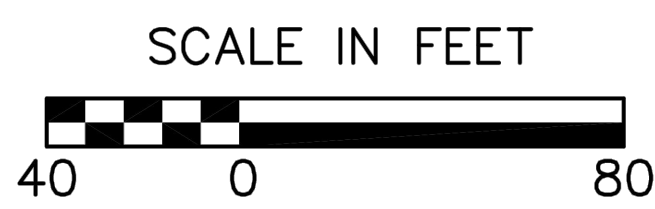
EXCAVATION NOTES:

1. PROVIDE MATERIALS FOR SHORING AND BRACING, SUCH AS SHEET PILING UPRIGHTS, STRINGERS AND CROSS BRACES, IN GOOD SERVICEABLE CONDITION
2. CONTRACTOR TO COMPLY WITH FEDERAL, STATE, COUNTY, AND LOCAL REGULATIONS REGARDING STABILITY, SHORING, BRACING, SHEATHING, AND SAFETY OF EXCAVATIONS
3. MAINTAIN SHORING AND BRACING IN EXCAVATIONS REGARDLESS OF TIME PERIOD EXCAVATIONS WILL BE OPEN
4. MACHINE EXCAVATION SHALL NOT BE PERFORMED UNTIL THE LOCATION OF EXISTING UTILITIES IN THE VICINITY OF WORK AREAS HAS BEEN DETERMINED BY CAREFUL EXCAVATION
5. EXCAVATION SHALL BE PERFORMED SO THAT THE SITE AND THE AREA IMMEDIATELY SURROUNDING THE SITE AND AFFECTING OPERATIONS AT THE SITE SHALL BE CONTINUALLY AND EFFECTIVELY DRAINED
6. PREVENT SURFACE WATER AND SUBSURFACE OR GROUNDWATER FROM FLOWING INTO EXCAVATED PIT AND FROM FLOODING THE SITE AND SURROUNDING AREA



RECEIVING PIT DETAILS

N.T.S.



ROADWAY OPENING PLAN

FOR
SITUATED AT
GARDEN CITY
TOWN OF HEMPSTEAD, NASSAU COUNTY, NEW YORK

PROJECT NO.:	-
DRAWN BY:	BR
CHECKED BY:	TFL
DATE:	8-7-2014
SCALE:	AS NOTED
FILE NO.:	-
CADD:	-
DRAWING NO.:	3-1
SHEET NO.:	- OF -



NELSON & POPE

ENGINEERS & SURVEYORS
572 WALKER STREET, SUITE 200
GARDEN CITY, NY 11530
PHONE (631) 427-5865 FAX (631) 427-5820
WWW.NELSONPOPE.COM

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October 15, 2014

Mr. Thomas Mathew, P.E.
Project Manager
CDM Federal Programs
110 Fieldcrest Avenue
Edison, New Jersey 08837

**Subject: Contract Submittal Review – 1451-1
Old Roosevelt Field Contaminated Groundwater Area Superfund Site, Southern
Plume Plant Expansion**

Dear Mr. Mathew:

This letter presents the responses by Arrowhead Contracting to your comments on the subject submittal. Comments have been incorporated in the shop drawings as appropriate or a response has been generated as indicated in this letter.

If you have any questions or comments please contact me at (913) 814-9994.

Sincerely,

A handwritten signature in black ink that reads "Doug Ronk". The signature is written in a cursive, flowing style.

Doug Ronk
Project Manager

CDM Comment:

1. General – All references to “CDM” should be changed to “CDM Smith”.

Arrowhead Response:

The text has been revised.

CDM Comment:

2. Section 1.2 – Please provide a brief overview of the work to be performed. For example clarify there is an existing treatment system with new wells being added to the well network and that treatment system equipment upgrades will be performed, etc.

Arrowhead Response:

The text has been revised.

CDM Comment:

3. Section 2.0 – Please include the role of the treatment system operator.

Arrowhead Response:

The text has been revised.

CDM Comment:

4. Section 3.0 – Please include any certifications required such as 40-hour HAZWOPER training or other construction safety training.

Arrowhead Response:

The text has been revised.

CDM Comment:

5. Section 5.0 – Please include independent checking of calculations, tables, charts, data, drawings, maps, and sketches, per Paragraphs 3.3.1 and 3.3.2 of specification section 01451. Recommend including a place for someone to sign off for the QC check on the technical review form.

Arrowhead Response:

The text has been revised.

CDM Comment:

6. Section 5.0 – Please also describe electronic record keeping.

Arrowhead Response:

The text has been revised.

CDM Comment:

7. Section 5.5 – The first sentence of the second paragraph states that the PM is responsible for the review and approval of “For Information Only” submittals. It is not clear who is responsible for “Engineer Approved” submittals.

Arrowhead Response:

The text has been revised.

CDM Comment:

8. Section 9.0 – In the bulleted list of the DFW’s, please fix the typo “GWET” to “GWTF”. Please add surveying, asphalt roadway construction/repair, installation of soil erosion and sediment control features, fence installation, and trenchless piping to the list of DFWs.

Arrowhead Response:

The text has been revised.

CDM Comment:

9. Section 11.1 – In the third paragraph, please clarify that although minor changes/variance to the SOW can be implemented in the field prior to FWV approval, verbal approval by CDM Smith is required before implementing the change.

Arrowhead Response:

The text has been revised.

CDM Comment:

10. Table 9-1 – Please add surveying, installation of soil erosion and sediment control features, fence installation, and trenchless piping to the table.

Arrowhead Response:

The text has been revised.

CDM Comment:

11. Table 9-2 – The geotechnical testing for the building should be removed and geotechnical testing for the trenchless piping should be added. Add “per lift” to the test frequency for in-place soil density testing for the trench.

Arrowhead Response:

The text has been revised.

CDM Comment:

12. Figure 2-1 – Please fill in the missing personnel. Please include the following:

- CDM Smith QA Manager - Jo Nell Mullins
- CDM Smith Health and Safety Manager - Shawn Oliveira
- CDM Smith Regional QA Coordinator – Jeniffer Oxford
- CDM Smith H&S Coordinator – Tonya Bennett
- CDM Smith Onsite Representative – Katelyn Reepmeyer
- EPA RAC2 QA Officer – William Sy

Arrowhead Response:

The text has been revised.

CDM Comment:

13. Appendix A – The Quality Control Authorization Letter should be provided in the final document.

Arrowhead Response:

The text has been revised.

**CONTRACTOR QUALITY CONTROL PLAN
REMEDIAL CONSTRUCTION ACTIVITIES
OLD ROOSEVELT FIELD CONTAMINATED GROUNDWATER AREA
SUPERFUND SITE
GARDEN CITY, NEW YORK**

SUBCONTRACT NO. 3320-048-001-CN

Submitted to:

**CDM Federal Programs Corporation
110 Fieldcrest Ave., 6th Floor
Edison, New York 08837**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher Drive
Lenexa, Kansas 66219**

October 2014

Revision 1

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N	Material Receipt Inspection Forms
O	Project Submittal Register

List of Acronyms

ANSI	American National Standards Institute
Arrowhead	Arrowhead Contracting Inc.
ASTM	American Society for Testing and Materials
CAR	Corrective Action Requests
CDFR	Chemical Data Final Report
CDM Smith	CDM Federal Programs
COC	chain-of-custody
CQCP	Contractor Quality Control Plan
CVOC	chlorinated volatile organic compound
DOE	U.S. Department of Energy
DFW	Definable Feature of Work
DQCR	Daily Quality Control Report
DRCR	Document Review Comment Record
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
FAR	Federal Acquisition Regulation
FSP	Field Sampling Plan
FWV	Field Work Variance
GAC	granular activated carbon
GWTF	Groundwater Treatment Facility
ISO	International Standards Organization
ITP	Initial Testing Program
MSDS	Material Safety Data Sheet
M&TE	measurement and test equipment
NCR	Nonconformance Report
NELAP	National Environmental Laboratory and Accreditation Program
NIST	National Institute of Standards and Techniques
O&M	Operations and Maintenance
PE	Professional Engineer
PG	Professional Geologist
PM	Project Manager
PO	Purchase Order
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCM	Quality Control Manager
QCT	Quality Control Team
RFP	Request for Proposal
RG	Registered Geologist
SAMP	Sampling, Analysis, and Monitoring Plan
SHSO	Site Health and Safety Officer
SOP	Standard Operating Procedure
SOW	Statement of Work

List of Acronyms (Continued)

SQC	Standard Quality Procedure
SSHP	Site Safety and Health Plan
SWO	Stop Work Order
USACE	U.S. Army Corps of Engineers

Terms and Definitions

Acceptance Criteria - Specified performance limits placed on characteristics of an item, process, or service defined in codes, standards, or other requirement documents.

Activities that Affect Quality - Activities that, if not performed properly, could compromise the validity of information or data reported, which could result in an unacceptable risk to the environment, health, or safety of the public or the workers involved, or could have a detrimental effect on the achievement of the project objectives.

Assessment - An inclusive term meaning any of the following: audit, performance evaluation, management systems review, peer review, or surveillance performed by or for management.

Audit - A formal, planned and documented activity performed to determine, by investigation, examination, or evaluation of objective evidence, the compliance with established plans, procedures, instructions, drawings, and other applicable documents, and the effectiveness of implementation. An audit should not be confused with surveillance or inspection activities performed for the sole purpose of process control or product acceptance.

Consequences of Nonconformance - Failure to comply with the acceptability criteria will result in the issuance of a Nonconformance Report. Nonconformance Reports will identify the nonconforming product or service, cause of the nonconformance, acceptability criteria not met, recommended corrective action, and verification of corrective action.

Contractor Quality Control Plan (CQCP) - A technical document that describes the management system for planning, performing, assessing, and inspecting work to ensure that the results demonstrate stated acceptability criteria are met. The CQCP will describe the organizational structure, QC policies and procedures, functional responsibilities, levels of accountability and authority, and necessary interfaces for organizations performing activities in support of the subcontract projects.

Corrective Action - Measures taken to rectify deviant conditions and, where necessary, to preclude repetition.

Deficiency - The failure or inability to meet the prescribed quality standards or procedures set forth for the project or site-specific activity.

Deliverable - A document, report, study, information, sample or other item required by the subcontract scope of work or specification to be submitted to the client. Deliverables are usually listed on a Submittal Register.

Document - Any written or pictorial information describing; defining; specifying; reporting; or certifying activities, requirements, procedures, or results.

Field Work Variance - An identified deviation from approved plans, procedures or specified requirements.

Field Work Variance Approval - Documented authorization from the Contracting Officer or Contracting Officer's representative to depart from approved plans, procedures or specified requirements.

Finding - An identified noncompliance or deviation from established requirements.

Independent (Personnel) - An individual or group of individuals qualified to analyze, review, inspect, test, audit, or otherwise evaluate data and work results because:

- a. They had no direct responsibility for, or involvement in, performing the activity or work
- b. They are not accountable for the activity or work result
- c. They do not report directly to supervisors who are responsible for performing the activity or work to be evaluated.
- d. They have appropriate technical capabilities to understand applicable procedures.

Inspection - Examination or measurement to verify whether an item or activity conforms to specific requirements.

Inspector - A qualified person who performs inspection activities to verify conformance to specific requirements.

Item - An all-inclusive term used in place of any of the following: object, facility, sample, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, system, unit, documented concepts, or data.

Nonconformance - A deficiency in implementation of a procedure or standard which renders the quality of an item unacceptable or indeterminate with respect to acceptability criteria. Examples of nonconformance's include, but are not limited to test failures, physical defects, incorrect or inadequate documentation, data losses, or deviation from prescribed processing, inspection, or procedure.

Objective Evidence - Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity that is based on observations, measurements, or tests that can be verified.

Observation - A statement of fact regarding the potential for a noncompliance which could lead to a more serious problem if not identified and/or corrected, but which does not constitute a lack of compliance with established requirements.

Procedure - A document that specifies or describes how an activity is to be performed.

Preparatory Inspection - A systematic, documented review of the readiness for startup or continued extended use of a facility, process, or activity. Preparatory inspections are typically conducted before proceeding beyond project milestones and prior to institution of a major phase of work activities.

Products and Services Acceptability Criteria - The standards by which products and services will be compared or judged to determine acceptance or compliance. Acceptability criteria will be based on the Subcontract Scope of Work, applicable specifications and drawings, applicable Engineering Manuals, Rules and Regulations, industry standards, standard codes of practice, and other applicable rules and regulations.

Project Manager - The Arrowhead organizational manager having direct responsibility for administration and direction of the subcontract.

Qualification (Personnel) - The characteristics or abilities gained through education, training, and/or experience, as measured against established requirements, such as standards, tests and/or evaluation that relate to the ability of a person to perform a required function.

Quality - The degree to which an item or process meets or exceeds the user's requirements.

Quality Assurance (QA) - The planned and systematic actions necessary to provide confidence that a structure, system, service, or component will perform satisfactorily. When the product is a report of a significant study or investigation, QA also comprises those planned and systematic actions necessary to provide adequate confidence in the validity and integrity of the reported data, methods, and procedures and in the protection, retrievability, and replicability of the data. The quality management system includes a multidisciplinary system of management controls backed by quality verification and overview activities that demonstrate completeness and appropriateness of achieved quality.

Quality Control (QC) - A systematic process consisting of criteria for development and a series of checks and reviews during development to ensure conformance with the Standards of Quality Products and Services. The process that verifies the attributes of a material, sample, process, component, system, or facility in accordance with prescribed quality or acceptability criteria.

Quality Control Documents - Those documents that establish the Arrowhead requirements and methods to implement the client's activities. These documents are identified as the Work Plan, Sampling, Analysis, and Monitoring Plan, Contractor Quality Control Plan, Standard Quality Procedures, Standard Operating Procedures, Field Work Variances, and objective evidence of implementation.

Quality Control Program - The overall program established by an organization to implement the requirements of the subcontract document. The program assigns responsibilities and authorities, defines policies and requirements, and provides for the performance and assessment of work. The Quality Control program is described in the CQCP.

Quality Control Record - A completed document that furnishes evidence of the quality of items and/or activities affecting quality.

Quality Control Team - A team of QC personnel responsible for ensuring that products and services meet the requirements of the Subcontract Scope of Work, acceptability criteria, policies, and applicable regulations.

Quality Products and Services - A product or service that conforms to the customers' requirements (functional, technical, aesthetic, environmental) and expectations, and is consistent with the appropriate technical criteria.

Receiving - Taking delivery of an item at a designated location. Receiving does not constitute "acceptance" of the item.

Repair - The process of restoring a nonconforming characteristic to a condition such that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirement.

Rework - The process by which an item is made to conform to original requirements by completion or correction.

Sampling and Analysis Plan - Document consisting of a Field Sampling Plan and Quality Assurance Project Plan written for a site-specific purpose to provide requirements for the collection and analysis of environmental samples.

Senior Management - The top Program/PM for each organizational unit.

Significant Condition Adverse to Quality - A condition that, if left uncorrected, could have a serious effect on safety, operability or project completion. This term includes environmental and programs compliance.

Significant Rework - A condition requiring removal or rip out and replacement of defective work or materials as a result of not meeting the project requirements or quality standards.

Standard Operating Procedure (SOP) - An approved document that details an operation, responsibilities, analysis, process, or action whose mechanisms are thoroughly prescribed and that is commonly accepted as the method for performing certain routine or repetitive tasks.

Standard Quality Procedure (SQP) - A set of implementing procedures which establish the responsibilities and describe the methods of performing quality-affecting activities in response to the CQCP requirements.

Stop Work Order (SWO) - The order issued to Arrowhead management, Arrowhead Subcontractor or Arrowhead Supplier to stop further processing, delivery, installation, or operation until corrective action of a nonconformance, deficiency, or unsatisfactory condition has occurred.

Supplier - Individual or organization that furnishes items or services in accordance with a procurement document. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, consultant, and their subtier levels.

Surveillance - The act of monitoring or observing to verify whether an item or activity conforms to specified requirements.

Training - To impart specific information with regard to job functions, which will achieve initial proficiency, maintain proficiency and adapt to changes in technology, methods or job functions.

Use-As-Is - An approved disposition permitted for a nonconforming item when it has been established that the item is satisfactory for its intended use.

1.0 Introduction

This document presents the Contractor Quality Control Plan (CQCP) for construction and operation and maintenance services associated with expansion of the Groundwater Treatment Facility at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site located in Garden City, New York. The document has been prepared for CDM Federal Programs Corporation (CDM Smith) under the Subcontract #3320-048-001-CN. This document has been prepared to describe the quality control (QC) system and procedures that will be implemented by Arrowhead Contracting, Inc. (Arrowhead) and its subcontractors to ensure that activities performed during the course of the subcontract will be of the quality necessary to meet project objectives and specifications.

This CQCP has been developed utilizing selected concepts from the best or accepted industry quality management practices and requirements from applicable national and international standards. These practices and requirements are based upon such documents as U.S Army Corps of Engineers, *Engineering and Design, Quality Management* (USACE, 1993); U.S. Environmental Protection Agency (EPA) Manual for Environmental Programs (EPA, 2000), *EPA Quality Manual for Environmental Programs* (1998a); U.S. Department of Energy Order 5700.6c, *Quality Assurance* (DOE, 1991); *EPA Requirements for Quality Management Plans, QA/R-2* (EPA, 2001); and International Standards Organization 9004 *Quality Management and Quality System Elements Guidelines* (ISO, 1994). These standards reflect the latest operational, technological, and engineering practices, thereby providing a sound QC systems approach to the project. This CQCP also incorporates the QC requirements as outlined in Section 01451 (Subcontractor Quality Control) of the subcontract specifications. Furthermore, please refer to the site specific QAPP for an in-depth discussion of chemical and laboratory quality assurance/quality control.

1.1 Overview

Arrowhead Contracting is firmly committed to producing an end product that meets the technical and quality requirements of the subcontract. This CQCP presents the details of Arrowhead's system for providing control of project activities affecting quality. The QC system consists of the following general elements:

- Roles, responsibilities, and authorities of personnel
- Areas of applicability

- Criteria and guidelines
- Policies and procedures
- Tools to assure and increase quality in project planning and implementation
- Documentation requirements
- Independent technical and quality reviews.

This CQCP is designed as a management tool, providing end-users with specific measures for determining whether the QC system is being implemented in an effective manner. Accordingly, this CQCP establishes procedures, protocols, and instructions for the management and control of items or activities affecting project quality and for verifying and documenting compliance with subcontract requirements. The QC measures addressed herein include:

- QC organization and responsibilities
- Personnel qualifications and training
- QC reporting
- Document and records control
- Procurement control
- Testing and measurement control
- Inspections
- Non-conformance control and corrective actions
- Change control
- Subcontractor control
- Material receipt and inspections

The remainder of this plan addresses each of these QC measures in detail.

This CQCP has been designed to focus on the processes used to plan, implement, and document compliance with the quality criteria and standards of this project. Documentation of the QC process will be provided through the use of standardized forms, logs and checklists, which are provided in the Appendices A through N. This type of documentation is a key tool for tracking QC performance and for determining whether an activity is in control or whether a non-conforming situation exists. If non-conformances are identified, through documentation or other means, appropriate corrective actions will be implemented.

1.2 Scope of Work

The project is located at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site located in Garden City, New York and is the location of an office park and a large retail shopping mall. Groundwater at the site is contaminated with volatile organic compounds (VOCs), particularly chlorinated VOCs such as tetrachloroethene (PCE), trichloroethene (TCE),

cis-1,2-dichloroethene (cis-1,2-DCE), dichlorodifluoromethane and 1,2-dichloroethane (1,2-DCA), and non-chlorinated VOCs such as methyl tert-butyl ether (MTBE). The remedy, as defined in the September 2007 Record of Decision, involves groundwater extraction and ex-situ treatment (pump and treat) in order to expedite the restoration of water quality in the aquifer in comparison with natural processes alone, and provide for vapor intrusion mitigation, if deemed necessary.

The objective of the remedial action is to achieve the goals of the Record of Decision (ROD), as shown on the Contract Drawings and Specifications. Work included under this contract includes expansion of the Groundwater Treatment Facility. The existing facility will be upgraded to treat a maximum flow rate of 500gpm. Work within the plant required to facilitate the increased flow will include replacement of transfer pumps P-1 and P-2, installation of three additional trays to the air stripper (for a total of 6), replacement of blower B-1, and modification to process piping and electrical distribution equipment. In addition to work within the treatment facility three extraction wellhead vaults will be constructed, approximately 2,000 linear feet of groundwater conveyance line will be installed, a new local control panel will be installed at the southern well field extraction wells, and a new electrical service connection will be constructed at the southern well field.

Arrowhead's scope of work includes the following activities:

- Preparing shop drawings
- Obtaining required permits
- Mobilizing to the site
- Preparing the site, including setting up work zones, support areas, and laydown area (i.e. for equipment/vehicle/materials storage), and locating utilities
- Clearing and grubbing
- Installing site utilities
- Installing GWTF transmission piping and well head construction
- Site restoration (including pavement restoration and seeding)
- Fence installation
- Demolition of selected GWTF equipment
- Installation of new GWTF equipment
- System proveout
- Completion of the Initial Testing Program
- Completing site cleanup/demobilization
- Completing post-construction submittals
- 1 year of operations and Maintenance

In addition, the following sampling will be completed. Details of the sampling requirements can be found in the QAPP.

- Sampling and analysis of groundwater influent and effluent and off-gas from the air stripper during the Initial Testing Program (ITP) (QAPP Worksheet #17b)
- Sampling and analysis of groundwater influent and effluent and off-gas from the air stripper during O&M of GWTF (QAPP Worksheet #17c)

1.3 Submittals

A wide variety of documents used to verify compliance with the project specifications, report test data, and provide documentation of project progress will be transmitted during the project. In general the submittals will cover the following topics.

- Preconstruction Submittals
- Shop Drawings
- Samples
- Design Data
- Test Reports
- Certificates
- Manufacturers Instructions
- Manufacturers Field Reports
- O&M Data
- Closeout Submittals

A reference copy of the project transmittal register is included as Appendix O

2.0 Organization and Responsibilities

The Arrowhead Quality Control Team (QCT) is responsible for identifying, reporting, and documenting activities affecting quality, as well as verifying the correction of products and activities that do not conform to the specified quality requirements. The QCT maintains a close working relationship with CDM Smith management, keeping them advised of situations, which, if not corrected or controlled, may adversely affect the overall quality of a project. A brief description of QC personnel responsibilities is provided in the following subparagraphs.

Table 2-1 presents a list of Arrowhead personnel with specific QC responsibilities. The overall project organization, including the positions discussed in this section, is depicted in Figure 2-1. Descriptions of the positions associated with health and safety are discussed in Section 2.0 of the Site Safety and Health Plan.

2.1 Project Manager

The Project Manager (PM) is responsible for the development and implementation of this plan. The PM will provide the overall direction of the program QC function. In addition, the PM will, as necessary, perform inspections (formally and informally), document reviews, and other quality functions as required to determine the continued effectiveness of this document. The PM will interface with CDM Smith on the quality functions of the project. The PM will conduct self-assessment audits on Arrowhead and subcontractors for compliance with this document and subcontract specifications. The PM will also review project deliverables. Other responsibilities of the PM will include but will not be limited to:

- Preparing documents and determining the applicable quality requirements (w/ concurrence of the Corporate QCM)
- Assigning the QC staff
- Reviewing project plans and procedures for quality issues
- Identifying the need for corrective actions and initiating, recommending, and coordinating solutions for project quality issues
- Concurring with disposition of non-conformances and verifying closure
- Reviewing procurement documents to ensure applicable quality requirements are adequately stipulated
- Serving as the Arrowhead coordinator for audits performed by external organizations, as applicable

2.2 Corporate Quality Control Manager

The Corporate Quality Control Manager (QCM) is responsible for the overall implementation of the QC program and reports to the President of Arrowhead. In the role, the Corporate QCM works with the PM to ensure that all project activities are implemented in accordance with all quality requirements, including this CQCP and the subcontract specifications. The Corporate QCM will have knowledge relevant to the requirements of the scope of work. The Corporate QCM has the authority to stop work that is not in compliance with the subcontract requirements and specifications. The Corporate QCM is responsible for assisting in the development and revision of this CQCP. Other duties of the Corporate QCM, as appropriate, include:

- Identifying the need for corrective action and initiating, recommending, and coordinating solutions for project quality problems with the appropriate project personnel
- Reviewing project plans and procedures to ensure that appropriate and relevant quality requirements have been included
- Approving project plans and procedures for quality issues
- Ensuring that project training requirements are satisfied
- Reporting regularly to project management on the status of QC implementation
- Disseminating applicable quality information to the project staff
- Concurring with disposition of project NCRs and verifying closure
- Verifying quality requirements, which are stipulated in project procurement documents

2.3 Project Quality Control Manager

The Project Quality Control Manager (QCM) is responsible for the implementation of the project specific QC program and reports to the Corporate QCM. In the role, the Project QCM works with the Corporate QCM, Site QCM, and PM to ensure that all project activities are implemented in accordance with all quality requirements, including this CQCP and the subcontract specifications. The Project QCM will have knowledge relevant to the requirements of the scope of work. Other duties of the Project QCM, as appropriate, include:

- Identifying the need for corrective action and initiating, recommending, and coordinating solutions for project quality problems with the appropriate project personnel
- Preparing QC checklists
- Reviewing project plans and procedures for quality issues
- Reviewing project plans and procedures to ensure that appropriate and relevant quality requirements have been included
- Ensuring that project training requirements are satisfied
- Reporting regularly to the Corporate QCM and project management on the status of QC implementation
- Disseminating applicable quality information to the project staff

- Concurring with disposition of project NCRs and verifying closure
- Preparing and/or approving Field Work Variances (FWVs)
- Verifying quality requirements, which are stipulated in project procurement documents.

2.4 Site Quality Control Manager

The Site QCM is responsible for field implementation of project QC in accordance with the requirements of this CQCP. The Site QCM, or an approved designee, will be onsite at all times during construction activities and will be responsible for the following:

- Conducting field QC inspection activities
- Reviewing and signing QC checklists
- Identifying and documenting non-conformances and ensuring closure of non-conformances
- Coordinating testing activities performed by subcontractors
- Completing Daily Quality Control Report
- Approving variances during field activities before work continues
- Approving, evaluating, and documenting the disposition of NCRs
- Overseeing and approving any required project training
- Providing indoctrination and training to subcontractor personnel performing quality related work
- Performing daily inspections (preparatory, initial, and follow-up) of definable features of work (DFWs) to ensure compliance with project acceptability criteria,
- Overseeing QC tests and inspections performed by subcontractors
- Working with the Project QCM to ensure that field activities meet applicable QC requirements as outlined in the CQCP.
- Assisting the Project QCM in preparation of documents for submittal to CDM Smith.

During O&M activities the QCM will be onsite as necessary and will provide training and review site data as needed.

2.5 Site Supervisor

The Site Supervisor Operator is responsible for general site activities, coordination of subcontractors, tracking work completed, and insuring that work is being performed in accordance with the plans and specifications. The Site Supervisor is also responsible for the coordination and implementation of various field QC activities. The Site Supervisor will maintain communication with the Site QCM with respect to planned activities, non-conformances and corrective actions, subcontractor activities, and activity-specific QC requirements.

2.6 Subcontracts Manager

The Subcontracts Manager has overall responsibility for administration of subcontracts and purchase orders related to the procurement of services, supplies, materials and equipment for project execution. This individual will work with the PM, Project QCM, and Corporate QCM to ensure that appropriate QC requirements are integrated with the procurement documentation. The Subcontracts Manager will also administer the subcontract agreement between Arrowhead and CDM Smith, including change orders and modifications. The Subcontracts Manager also has overall responsibility for project billing and accounts payable. This function reports to the PM.

2.7 Water Treatment Plant Operator

The Water Treatment Plant Operator is responsible for routine operation, maintenance, collection of system performance data, and samples for offsite analytical analysis. The Plant Operator reports to the Project PM.

3.0 Personnel Training and Qualifications

Project activities will be performed by personnel qualified on the basis of education, experience, and training. Under the direction of the Site QCM, training will be provided to project personnel (including subcontractors) to communicate project QC requirements. This section discusses the methods for ensuring that project personnel are properly qualified and trained.

3.1 Project Staff Qualifications

Key management and technical staff qualifications will be evaluated by the PM to ensure that assigned personnel meet the minimum requirements as specified in the subcontract. The evaluation will occur prior to participating in project work activities. Arrowhead personnel assigned QC responsibilities (refer to Table 2-1) will be qualified on the basis of training, education, and/or experience. The qualifications of individuals will be documented by resumes, which include employment histories, professional registrations, and certifications (see Appendix B). Resumes of project staff and site personnel will be maintained in the record file system maintained in the Arrowhead Management Office.

3.2 Project-Specific Training

The PM and the Site QCM are responsible for ensuring that site personnel are properly instructed and trained in the implementation of project plans and procedures prior to their involvement in project activities. Individuals will not be permitted to work on activities, which for which they are not trained or qualified. Attendance at training sessions will be documented on a Training Attendance Record (Appendix C). Informal "on-the-job" training may be employed for training new employees and for training employees in new work activities. Experienced project staff and quality personnel will be available to supervise, counsel, and instruct less experienced staff. The project-specific training program will address:

- QC policies and procedures
- Scope of work, plans, and procedures
- Field documentation requirements
- Required field tests and measurements
- Applicable specifications and project requirements
- Organizational interfaces and responsibilities
- Non-conformance control and corrective action procedures

The training program will be structured to emphasize correct performance of work. Emphasis will be placed on ensuring adequate documentation of processes and activities.

3.3 *Equipment Training*

Personnel will receive "hands-on" training in the operation, maintenance, repair, and calibration of equipment, instruments, and tools prior to their utilization. The instructor (Site QCM, Site Supervisor, equipment manufacturer or supplier representative, or other trained/qualified personnel as appropriate) will review with trainees the operation procedures or operation and maintenance manuals of the equipment. The trainee will demonstrate for the instructor the proper operation and maintenance of equipment through utilization of that equipment. Documentation of equipment training will be recorded on a Training Attendance Record (Appendix C) or certificates provided by the manufacturer or the supplier.

3.4 *HAZWOPER Training*

Personnel involved in the routine operation of the treatment system who have an exposure potential to the COC's (i.e. plant operator) will be required to have current HAZWOPER training and be enrolled in Arrowhead's medical monitoring program. Subcontract personnel performing tasks that could involve exposure to COC's will be required to document current HAZWOPER certification prior to beginning work.

4.0 Daily Quality Control Reports and Monthly Operations and Maintenance Reports

Arrowhead will prepare a Daily Quality Control Report during the construction phase of the project. The report will be prepared by the Site QCM and will document work performed, material delivered, and any subcontractor activities at the site. The report will be submitted to CDM Smith following review by the PM. The DQCR will include the following items:

- A brief summary of the work performed by Arrowhead and subcontractors
- Location(s) of work
- Summary of manpower (name, trade, and hours worked)
- List of materials received and consumed
- Inspection results, including copies of inspection checklists (refer to Section 10.0)
- Tests completed and results
- Location and description of non-conformances (as applicable)
- Corrective actions completed (as applicable)
- Instructions or work directives received from CDM Smith
- Green remediation activities
- Other comments with respect to QC

During the O&M phase of the project, Arrowhead will prepare a Monthly Operations and Maintenance Report to document the O&M activities and relevant QC issues for each month. The monthly O&M report will be prepared by the Plant Operator and QCM and will document work performed, material delivered, and any subcontractor activities at the site. The report will be submitted to CDM Smith following review by the PM. The monthly O&M report will include the following items:

- A brief summary of the work performed by Arrowhead and subcontractors
- Summary of plant operations, maintenance performed, and system operation status
- Summary of manpower (name, trade, and hours worked)
- List of materials received and consumed
- Inspection results, including copies of inspection checklists (refer to Section 10.0)
- Testing results, including laboratory analytical data
- Location and description of non-conformances (as applicable)
- Corrective actions completed (as applicable)
- Instructions or work directives received from CDM Smith
- Calibration results for field testing instruments
- Other comments with respect to QC

Applicable test reports, inspection checklists, and other field submittals will be included as attachments to the report.

5.0 Document and Records Control

This section describes the methods and practices for the control of review, approval, distribution, storage, and maintenance of project-related documents (specifications, drawings, reports, plans, procedures, etc.) and records (instructions, correspondence, data, calculations, completed, checklists, certificates, etc.) including those provided to Arrowhead by subcontractors, vendors, and laboratories.

5.1 Document and Records Review

Prior to issuance or use, project documents and records (as appropriate) will be reviewed and approved. The review will cover administrative, technical, and quality issues as applicable to the document or record under consideration. The level of effort required for review will be commensurate with the complexity and scope of the document or record. For example, a project planning document will receive a higher level of review than a well completion diagram or inspection report. Nevertheless, all project documents and records will be reviewed and approved to the extent determined by the Corporate QCM or PM. Documents requiring formal approval will be denoted by a signature and date page, which will include reviewer signatures, including the Arrowhead PM and Corporate QCM. Both technical review and peer review, as necessary, will be performed to ensure that project documents are technically correct and meet the requirements of the subcontract. Technical reviews will be conducted on reports, plans, documents procuring technical services, and work instructions prior to being issued to CDM Smith. Peer reviews will be based on the scope and needs of individual document.

5.1.1 Technical Review

A technical review is an in-depth analysis and evaluation of documents (primarily plans, procedures, reports, and instructions) for applicability, correctness, technical adequacy, completeness, appropriateness of interpretation, and assurance that subcontract requirements are satisfied. This review includes independent checking of calculations, tables, charts, data, drawings, maps, sketches, etc. This type of review will be independently performed by qualified member(s) of the QCT, other than person(s) who prepared the original document. Independent reviewers may be selected from within Arrowhead or Arrowhead subcontractors, or they may be outside consultants retained in a review capacity. The review of plans, procedures, and reports is the responsibility of the PM or Corporate QCM. This PM or Corporate QCM will identify the documents to be reviewed, select qualified personnel to perform the reviews, participate in the review of documents, and verify that the review process is completed prior to document release.

Technical reviews will, as appropriate, focus on the following aspects of the document under consideration:

- Requirement Satisfaction - Is the objective of the report defined? Does the document satisfy the subcontract SOW, subcontract requirements, and pertinent regulatory requirements?
- Completeness – Does the document provide all necessary information? Does it include all figures, tables, appendices, and attachments required to completely document the information?
- Technical Correctness - Is the content of the document technically defensible? Are conclusions properly supported by correctly interpreted data? Are all figures, tables, and computations presented in the document correct?
- Executive Summary - Does it state the purpose of the document? Is it informative? Does it describe the SOW and summarize pertinent results and conclusions?
- Introduction - Does it clearly describe the problem(s) addressed by the document, state the objectives and scope of the document, and present pertinent background information?
- Methods - Were appropriate techniques used or recommended for the work? New, nonstandard methods should be described in the document text.
- Assumptions - Are assumptions clearly stated and justified?
- Text - Is it organized and presented in a logical sequence that contains the basic information, interpretation of that information, and results or conclusions of the interpretations?
- Appendices and Tables - Do they clearly present basic information? Appendices and tables should be interpreted and referred to in the text, but should be understandable without the text. Have they been prepared, checked, and approved?
- Conclusions or Results - Do they summarize the principal findings of the backup work? Do they answer each of the objectives described in the introduction? Are they technically defensible? No information should be given that was not discussed in the body of the document.
- References - Are all references cited in the text, tables, and figures included in a list of references? Are references cited correctly? Were pertinent references omitted in preparing the document?

5.1.2 Peer Review

Peer reviews are documented reviews performed by qualified personnel who are independent of the original work, but whom have the expertise to perform the work. Peer reviews are in-depth critical reviews and evaluations of documents, material, or data that require interpretation or judgment to verify or validate results or conclusions, or when conclusions, material, or data contained in the document go beyond reasonably available technology, or when technical criteria and requirements do not exist or are being developed. The PM or Corporate QCM will determine if a peer review will be required, the points in the work when the review will be performed, and the independent individual(s) who will perform the review. The need for peer review will be based on the level of technology required for the subcontract deliverable. Peer reviews will be performed after completion of internal document checks and prior to issuing the document to CDM Smith.

Documents requiring peer review include:

- Work Plan
- Health and Safety Plan
- Contractor Quality Control Plan
- Environmental Protection Plan
- Quality Assurance Project Plan
- Shop Drawings
- Engineering Calculations
- As-built Shop Drawings

5.1.3 External Review

The PM or Corporate QCM will respond to CDM Smith comments (when provided) on all project submittals. CDM Smith comments will be forwarded using a standard transmittal form (Appendix F), “CDM Federal Programs Corporation Submittal Review”. As required, revised documents will be resubmitted to CDM Smith after the comments are addressed or resolved. Section 5.5 provides further details with regard to submittal distribution.

5.2 Internal Review and Approval Process

When a document is ready for review, the PM or Corporate QCM will define the specific review process commensurate with the technical complexity/requirements of the document. The following procedure will be implemented for a document requiring a comprehensive review.

- The PM selects the appropriate technical/peer reviewers and schedules review times.
- The author completes the required portions of the Document Review Comment Record (DRCR) (Appendix F), and sends the appropriate DRCR and a copy of the document to each reviewer. The document copy should contain all texts, tables, figures, appendices, and attachments.
- Each reviewer examines the document and records any major comments or corrections on the DRCR. Recommended corrective actions will be indicated for each comment/correction. Minor comments/corrections (i.e., typos, grammatical errors, incomplete referencing, inconsistencies, drafting errors, and format errors) may be noted in red in the reviewer's document copy and need not be handled through the DRCR system.
- The reviewer and author discuss each DRCR comment/correction and document the agreed-upon dispositions on the DRCR. If agreement cannot be reached, the PM will make the final decision. If no action is to be taken on a particular comment/correction, adequate justification must be indicated.
- The author makes the agreed-upon revisions.
- The reviewer examines the document revisions. The reviewer and author then sign the DRCR for each satisfactorily completed comment/revision.
- When all comments/revisions have been closed, the author and reviewer then sign the "Closed" portion of the DRCR.
- If approval signatures are required on the document, each individual in the approval chain signs the approval page.
- The author submits the completed DRCR to project files along with the original copy of the document.

5.3 *Controlled Documents*

Controlled documents are documents, which have been assigned unique identifiers (i.e., copy or revision number) and are issued to a specific person, organization, or facility. These documents are maintained current by distributing revisions and addenda to holders on a controlled list.

Controlled documents will be managed in a manner that will account for all copies of the document issued, and establish that the latest, approved versions of the documents have been distributed.

Documents requiring controlled distribution include those documents specifying quality requirements or prescribing activities affecting quality. In addition to this CQCP, controlled documents for the project include:

- Project Work Plan
- Site Safety and Health Plan (SSHP), incorporating an Environmental Monitoring Plan, and Site Security Plan
- Environmental Protection Plan (EPP), incorporating a Waste Management and Disposal Plan
- Treatment System Operations and Maintenance Plan

The control system will include a document control log and/or drawing log, which as a minimum includes the number and the title of the document, latest approved revision number, name of individual or organization the document was issued to, document control number, and status of superseded revisions. The Corporate QCM will be responsible for the control and issuance of controlled documents. The Corporate QCM or designee will ensure the following actions are taken with regard to controlled documents:

- Controlled documents and their distribution are identified
- Document and drawing control logs are prepared and updated
- Personnel responsible for the preparation, review, approval, and issuance of project documents and revisions are identified
- Instructions of how obsolete or superseded documents are removed or replaced by applicable revisions are included with the document distribution forms
- When draft documents are released prior to review and approval, they are identified and controlled as such.

5.4 Records

Quality records are those data, certificates, correspondence, etc. that provide direct documentary evidence of the quality of items, activities, services, compliance to the subcontract, or regulatory requirements, and which have been completed and submitted for acceptance and retention.

Administrative records, such as general correspondence, do not directly provide documentary evidence of the quality of items or activities or compliance to the subcontract or regulatory requirements.

5.4.1 Indexing and Filing of Records

The indexing and filing of records will be performed by the Corporate QCM and maintained in a central filing system located at the Arrowhead project support office. Project record files will be

organized by project file categories in accordance with Arrowhead's standard master file index system. All of the categories may not be applicable to specific projects; consequently, categories will be added or deleted as appropriate to the project. Working documents maintained at the project site will not require filing until such time that they are no longer needed by field management personnel. The Corporate QCM is responsible for controlling and assembling project records and performing audits of the record files to verify continued effectiveness of the system.

5.4.2 Storage of Records

Records will be maintained and stored in a manner, which will preclude loss, damage, or any other detrimental conditions of the records. The filing system will provide for security from unauthorized entry to prevent loss of any records by theft or inadvertent mishandling. Only authorized personnel will be permitted to remove records from the filing area. A published list of authorized personnel will be available in the file area. A sign-out log will be used to keep track of files removed from the filing system. The borrower's name, the date the file was removed, the file title and category, and date returned will be recorded on the sign-out log.

5.4.3 Electronic Record Storage

Electronic records will be maintained on servers located at the Arrowhead corporate headquarters in Lenexa, Kansas. Routine daily backup of server data is maintained by a third party located offsite. Access to data is restricted to Arrowhead employees assigned a user ID and password.

5.5 Submittal Distribution

Project submittals to CDM Smith, identified in the SOW, will be transmitted with the Transmittal Form provided in Appendix F, "Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance". The Site QCM and PM will prepare and the PM will transmit the subcontract deliverables identified in the project-specific Submittal Register, Eng Form 4288. Transmittal numbers will be issued by the PM, and the Submittal Register will be maintained and updated on a routine basis as submittals are approved by CDM Smith. The PM will determine CDM Smith requirements for the deliverable submittal, including the number of copies required and to whom the report copies should be transmitted. Documents will not be distributed to outside agencies or individuals without CDM Smith approval.

The PM is responsible for the review and approval of “For Information Only” and “Engineer Approval” submittals. The submittals will be reviewed for conformance to specified requirements, completeness, and accuracy. Submittals requiring modifications or changes will be returned to the originator, subcontractor, or vendor for correction. The Project QCM will confirm compliance with all subcontract requirements by signing and dating the transmittal form in the signature block prior to submitting to CDM Smith. Variations from the project requirements or specifications will be noted and described in full on the Transmittal Form (Appendix F). CDM Smith approval of such variations will be required.

Submittals that have been returned unapproved or returned with comments requiring resubmittal will be so noted on the Submittal Register and re-entered as a revision. The Project QCM will monitor the Submittal Register to verify submittals are being controlled, scheduled, and tracked in an effective manner. Submittals to Arrowhead from subcontractors or vendors will be reviewed and approved by the PM or Project QCM (refer to Sections 5.1 and 5.2) prior to transmitting the submittals to CDM Smith.

Submittals with approval pending, or submittals that must be resubmitted for approval due to pending comments, will be processed in the same manner as the original submittal. Once revisions/corrections are incorporated, the revised submittal will be resubmitted and retransmitted using the Transmittal Form.

6.0 Procurement Control

This section describes the requirements for the preparation, review, and approval of procurement documents for products and services. Procurement of items, materials, and services will be performed in accordance with Arrowhead Procurement Procedures, Federal Acquisition Regulations (FARs), and the requirements of the subcontract agreement.

6.1 Procurement Document Technical Preparation

Under the direction of the PM, the procurement process is initiated by completing a Purchase Order (PO) (Appendix G). The person who prepares the PO is responsible for identifying applicable technical requirements. Large procurements, subcontracts, and certain equipment purchases may require the use of technical specialists or engineers to assist in preparation of the PO technical requirements. Procurement documents will state applicable requirements for technical performance, quality, acceptability, and documentation, as appropriate. Technical performance requirements may include:

- General requirements
 - Scope of work
 - Personnel qualifications and training
 - Licenses or permits
- Regulations and standards
- Acceptance Criteria (i.e., material composition, physical, and chemical requirements)
 - Type
 - Composition
 - Grade
 - Properties
 - Size/volume/quantity
 - Packaging
 - Handling
 - Shipping
 - Storage
- Delivery schedules
- Work procedures and certifications
- Performance and acceptance criteria
- Documentation indicating compliance with requirements (i.e., mill certificates, certificates of analyses, certified copies of performance tests, certificates of compliance, Operation and Maintenance Manuals, wiring diagrams, catalog cut sheets, etc.).

Technical requirements will either be directly included in the procurement documents or referenced to specific drawings, specifications, statements of work, procedures, or regulations (along with specific revision numbers and issue dates) that describe the items, materials, or services to be furnished.

6.2 Procurement Document Technical Review and Approval

Purchase orders and their attachments, including requests for proposals and quotes, will be reviewed by the PM or Corporate QCM. Attachments will be reviewed for the incorporation of appropriate quality requirements as listed in Section 6.1. Quality requirements will be based on approved project plans, specifications, drawings, and other applicable project requirements. The PM or Corporate QCM indicate concurrence with the PO and attachments by signing the PO. Changes or revisions resulting from the quality review will be incorporated into the PO by the originator. When approved, the PO is submitted to the procurement department under the direction of the Arrowhead Subcontracts Manager. The procurement department is responsible for issuing the POs to the selected supplier or subcontractor. For professional and construction services, the Subcontracts Manager will prepare a subcontract agreement for the selected firm. The subcontract agreement will incorporate the original PO and attachments. Revision(s) to procurement documents will be initiated using the same method as the original procurement, and will be accomplished taking into consideration any additional or modified design criteria, additional or modified technical performance requirements (refer to Section 6.1), or exceptions or changes requested by the supplier or subcontractor and the effect the changes will have on procurement.

6.3 Procurement Source Evaluation and Selection

Subcontractors and suppliers of quality related materials, including construction service subcontractors and laboratories, will be evaluated prior to use of their materials or services. Only pre-qualified subcontractors will be used. The evaluation will include the following, as appropriate:

- Historical Performance – The previous ability of a potential subcontractor to provide an item or service in a satisfactory manner will be evaluated. The experience of other purchases of similar items or services provided by the prospective subcontractor and any Arrowhead records of previous procurements can form the basis for the evaluation. The subcontractor's reputation and experience in the industry will also be considered.

- Subcontractor Records – A review of the subcontractor's current quality records will be evaluated.
- Prequalification Audit – The subcontractor's management capability, plant facilities, and technical or quality capabilities will be directly evaluated through a prequalification audit.

During the term of the purchase order and/or subcontract agreement, the quality of field activities affecting subcontractors or vendors will be monitored to verify the quality of the items and services being furnished. This will be accomplished through inspection and monitoring of field activities consistent with the extent of ongoing activities and the project schedule. Materials testing and analytical laboratories are required to meet the requirements of Section 7.0 of this plan prior to the start of activities or work on this project.

7.0 Testing Control

This section describes the required certifications and qualifications of testing and analytical services, primarily chemical analysis of compliance and performance monitoring samples.

7.1 Qualifications and Certifications of Testing Services

The following qualifications and certifications are applicable to the various testing services that will be used during the project:

- Analytical testing laboratories to be utilized will be accredited by the National Environmental Laboratory and Accreditation Program (NELAP) and the State of New York Department of Health.
- Materials testing (i.e. in-place density testing) will be conducted by an approved geotechnical testing firm licensed in the State of New York.

In addition, Arrowhead Contracting requires all subcontractors, including testing and analytical services, to be pre-qualified under Arrowhead procedures prior to award of a PO. This ensures the competence and qualifications of the laboratories to perform specific testing services.

Arrowhead QC procedures support the procurement process by incorporating laboratory inspections and audits (as necessary), evaluating supporting documentation, staff qualifications, equipment, and historical data. The Corporate QCM will verify that the required tests to be performed by the testing service are within the service's capabilities and that the procurement documents (refer to Section 6.0) correctly specify the test requirements, acceptance criteria, data, and reporting requirements. The testing service's capabilities will be reviewed with respect to accreditations, availability of instrumentation, compliance with calibration requirements, and suitability of environmental conditions, and other criteria as appropriate.

7.2 Specification of Testing Procedures

Tests will be performed in accordance with the subcontract specifications and approved planning documents that specify the requirements and criteria for preparation, performance, acceptance, and documentation of the testing activities. (For example, the SAMP/QAPP contains specific QA procedures and requirements for analytical testing.) Testing procedures will incorporate the following elements, as applicable:

- Instructions and prerequisites to perform the test
- Referenced standards, procedures, specifications, or methods

- Use of test equipment
- Calibration requirements
- Hold or witness points
- Environmental conditions
- Test personnel qualifications and certifications
- Identification of required test data and reporting format
- Acceptance criteria.

7.3 Analytical Testing

The Corporate QCM is responsible for monitoring analytical laboratory activities to verify, as appropriate:

- Overall chemical quality control via compliance with the QAPP
- Laboratory sample preparation and testing procedures in accordance with the QAPP and referenced procedures
- Sample collection, identification, and handling in accordance with the FSP
- Chain-of-custody (COC) documentation
- Data quality objectives, transfer, reduction, evaluation, and verification in accordance with the QAPP
- Test results, raw data, and validated data packages for compliance with analytical requirements and QAPP
- Required reports, including the Chemical Data Final Report (CDFR) and Data Validation Reports

7.4 Test Failures

Unacceptable test results will be brought to the immediate attention of the Corporate QCM for resolution prior to continuing with the activity. Test failures will result in the issuance of a Nonconformance Report (NCR) or a Corrective Action Request (CAR). Nonconformance Reports and CARs will be controlled, tracked, and closed out in accordance with the procedures described in Section 10.0.

7.5 Test Result Reporting and Documentation

The results of the geotechnical, material, and analytical tests will be documented using the laboratory approved test reports or data package requirements (as specified in the purchase order), as applicable. The test reports will include, as appropriate:

- Applicable subcontract requirements, test methods, and analytical procedures used
- Results of tests
- A statement certifying the tests conform to the established test method requirements

- Applicable raw data, supporting QC information, and electronic deliverables
- Signature of authorized representative of testing laboratory.

The Corporate QCM or PM will review the results for conformance to the testing procedures and acceptance criteria prior to submitting the results to CDM Smith. The Corporate QCM will submit the test results in conjunction with the Monthly O&M Report (refer to Section 4.0).

8.0 Calibration and Maintenance of Measurement and Test Equipment

This section describes the responsibilities and methods for the control, calibration, and preventative maintenance of measurement and test equipment (M&TE) used in the field, including various meters, gauges, and monitoring devices. This section does not present information with regard to the calibration maintenance of testing equipment used by off-site laboratories or third-party testing services. These requirements are discussed in further detail in the QAPP.

8.1 Calibration Control

Field M&TE will be calibrated prior to being used for project activities and at prescribed intervals thereafter. During M&TE usage, operational checks of the equipment will be performed to verify the equipment's continued accuracy and operational function. Calibrations of M&TE will be performed by trained and qualified personnel, approved external agencies, or by the equipment manufacturer.

Calibration(s) will be performed in accordance with approved procedures or manufacturer's recommendations using appropriate standards, which have known valid relationships to nationally recognized standards (i.e., National Institute of Standards and Technology) or accepted values of natural physical or chemical constraints. If no national standard exists, the basis for calibration will be documented and approved by the PM and by the Corporate QCM. The following types of calibrations and checks will be performed as applicable for the specific instrument being used:

- Periodic Calibrations – Periodic calibrations are performed at prescribed intervals established for the M&TE to assure that the equipment is operating within its designed range and accuracy. These are usually performed by outside agencies or the M&TE manufacturer. A calibration certificate will be provided documenting the operational and functional acceptance of the M&TE.
- Specific Calibrations – Specific calibrations are performed for specific measurements or tests. These calibrations vary depending on the specific instrument and operating procedure. Specific calibrations are performed prior to the start of work and are reestablished at prescribed intervals that have been predetermined and are instrument and procedure specific.

- Calibration Checks – Calibration checks are performed to provide a quick, accurate, and consistent method of checking the specific calibration's correctness. This is accomplished by establishing a known acceptable/repeatable response during the specific calibration and periodically checking that response during the M&TE usage.

Calibration of M&TE will be performed in accordance with the procedures established by the instrument manufacturer or a nationally recognized authority (i.e., ASTM), as applicable. The frequency calibrations will also be based these procedures. If periodic calibration is required, a label will be attached to M&TE indicating the date of current calibration, and due date of the next required calibration. Specific calibrations will be performed prior to each use. Once the M&TE calibration is completed, a reference value or response will be established and checked periodically during equipment usage to verify calibration accuracy (i.e., calibration check).

8.2 Equipment Identification

Measurement and test equipment will be uniquely identified by the manufacturer's serial number or other unique, assigned number. Whenever possible, the M&TE identification number will be permanently marked on the instrument. It will be located in a readily visible area that will not infringe on the equipment function or performance, preferably on the outside casing (i.e., top, bottom, or side). If permanent markings are not practical, an identification label will be affixed with the identification number clearly visible. This label will be replaced as needed to provide clear identification of the M&TE. A list of M&TE used on-site will be maintained by the Site QCM.

8.3 Reference Standards and Equipment

Calibration reference standards and equipment will have known relationships to the National Institute of Standards and Techniques (NIST) or other nationally recognized standards, consistent with the testing method. If a national standard does not exist, the basis for calibration will be fully documented and approved. Physical and chemical standards will have certifications traceable to NIST, EPA, or other recognized agencies. Standards that are repackaged or split will also have traceable lot or batch numbers transferred onto the new container.

8.4 Calibration Failure

Each individual user of M&TE is responsible for checking the calibration status of equipment to be used and confirming the acceptable calibration status prior to use. Equipment for which the periodic calibration period has expired, equipment that fails calibration, or equipment that becomes inoperable during use will be removed from service and tagged as out-of-service.

Out-of-service M&TE will be segregated from operational M&TE when practical. The specific reason for removal from service and the date of removal will also be stated on the out-of-service tag. The M&TE will then be repaired and/or recalibrated by the appropriate vendor or manufacturer as deemed appropriate. Measurement and test equipment that cannot be repaired will be replaced, as necessary, to provided support to the project.

Results of activities performed using equipment that has failed recalibration will be evaluated by the Site QCM and PM. If the activity results are adversely affected, the results of the evaluation will be documented as a nonconformance in accordance with Section 11.0.

8.5 Calibration Documentation

Specific calibration records will be prepared and documented for each M&TE used during the project. Calibration data will be documented on an Equipment Calibration Log (Appendix F) or a similar form. Calibration certificates are also an acceptable form of documentation. The PM or designee will be responsible for reviewing the calibration data for appropriateness, accuracy, readability, and completeness. Calibration documentation requirements for health and safety related M&TE are presented in the SSHP. Calibration documentation requirements for field sampling and screening M&TE are presented in the QAPP.

9.0 Inspections

This section provides the criteria for the performance of quality control inspections as part of the overall Contractor Quality Control Plan. Inspection of routine O&M procedures will be accomplished using checklists, which are discussed in the O&M Manual.

To facilitate the inspection process, individual Definable Features of Work (DFWs) are identified for significant item of work. Each DFW, in turn, will undergo a three-phase inspection process. Under this approach, the Site QCM, by examination or measurement, determines that a particular DFW complies with the specified quality requirements. The three-phase inspection system consists of preparatory, initial, and follow-up inspections for each DFW. The Site QCM will coordinate inspection activities with the PM, subcontractors, and field personnel. Inspection activities will be performed on a continuous basis for all on-going DFWs. The identified DFWs are:

- Clearing and grubbing
- Land Surveying
- Installation of erosion and sediment control features
- Yard piping trenching and installation
- Directional boring
- Site utility installation
- Effluent outfall manhole termination
- Extraction wellhead construction
- Extraction well pump installation
- Demolition of selected GWTF system equipment
- Groundwater treatment system equipment installation
- Installation of secondary electrical service
- Rough-in of electrical equipment
- Installation of electrical panel boards and motors control centers
- Installation of process control equipment
- Site grading and restoration
- Asphalt roadway repair
- Fence installation
- System start-up and performance testing
- Chemical data acquisition
- Operation and maintenance

9.1 Definable Features of Work

A DFW is defined as a major work element that must be performed in order to execute and complete the routing operation or maintenance item. It consists of an activity or task that is

separate and distinct from other activities and requires separate control. Refer to Table 9-1 for a DFW inspection log.

Example copies of inspection checklists that would be developed for a DFW are presented in Appendix J.

9.2 Preparatory Inspections

Preparatory inspections will be performed prior to the initiation of all DFWs. The preparatory inspection is performed in advance of any work being performed to determine whether preliminary activities have been completed to the extent that the DFW can proceed. This inspection will be conducted by the Site QCM and will be attended by field personnel and subcontractors. The preparatory inspection will be scheduled prior to the start of the DFW. All affected parties will be notified in advance of the inspection to coordinate their participation.

The preparatory inspection will include, but is not limited to:

- Review of pertinent subcontract requirements, plans, and specifications
- Review of required control inspections and test requirements
- Review of reports, forms, and checklists that need to be filled out during the activity
- Review of subcontracts and purchase orders
- Review of required licenses, permits, and certifications
- Establish that required planning documents have been reviewed and approved by the client
- Establish that the required materials and equipment for commencement of the DFW are on-hand, available, in working order, and are in accordance with plans and specifications
- Establish that the preliminary work required to begin the DFW is complete and conforms to approved plans
- Schedule the date that the initial inspection will be performed
- Review and discuss the health and safety requirements for the DFW

A preparatory inspection checklist is included in Appendix J.

For off-site testing laboratories, the Project QCM will conduct the preparatory inspection prior to the start of sampling activities. The preparatory inspection will be conducted by teleconferencing with the Laboratory QC Manager and/or Laboratory Project Manager. During the teleconference, pertinent QC requirements (as outlined in the SAMP/QAPP) will be discussed with the laboratory representatives, including sample turn-around-time, data quality requirements, and data reporting requirements.

9.3 Initial Inspections

Initial inspections will be conducted at the commencement of a DFW. The initial inspection will provide the opportunity for the Site QCM to observe the actual initiation of the work activity and the individual tasks associated with DFW. The inspection will be performed on a representative sample of work to evaluate the following criteria:

- Compliance with subcontract requirements, plans, and specifications
- Acceptable levels of workmanship
- Proper operation of equipment
- Identify use of defective or damaged materials
- Identify improper procedures or methods
- Acceptable test or inspection results
- Compliance with the health and safety requirements
- Completion or collection of pertinent records

An initial inspection checklist is included in Appendix J.

9.4 Follow-up Inspections

Follow-up QC inspections of field activities will be performed on a daily basis when work on a DFW is in progress. The follow-up inspections will be performed until the DFW is completed. The following items will be performed during the follow-up inspection:

- Verify compliance with subcontract requirements, plans, and specifications
- Verify proper operation of equipment
- Verify level of workmanship, if applicable
- Verify test or inspection results
- Verify that nonconformance issues are identified, corrected, and re-inspected
- Verify compliance with the health and safety requirements
- Verify completion or collection of pertinent records

A follow-up inspection checklist for the Old Roosevelt Field project is included in Appendix J.

Follow-up inspections will not apply to off-site testing laboratories. Subcontract laboratories will follow their approved QA Plan and applicable standard operating procedures. The usual processes followed for these instances will include teleconferencing with laboratory personnel on a weekly basis and extensive review of the completed process (data packages) for elimination of any errors processed during the activity.

9.5 Final Inspections

Final inspections will be conducted in accordance with Section 01451 of the specifications. As appropriate, the results of Final Inspections will be documented on the Final Inspection Form provided in Appendix J. The four final inspections are:

- Punch-Out Inspection – conducted by the Contractors QC officer to develop and address a punch-list of items that need to be addressed.
- Pre-Final Inspection – The Engineer performs this inspection and develops a Pre-Final Punch List of items that need to be addressed. The Contractor will correct the items on the Pre-Final Punch List.
- Final Inspection – The final inspection is attended by representatives of the Engineer and Contractor plus additional federal, state, and local government personnel, as applicable.
- Post-Final Acceptance Inspection – Following the one-year operational and functional period, the post-final acceptance inspection will be held attended by representatives of the Engineer and Contractor plus additional federal, state, and local government personnel, as applicable.

9.6 Inspection Documentation

The preparatory, initial, and follow-up inspections will be documented on the checklists provided in Appendix J. The CDM Smith construction supervisor will be notified prior to any inspections. These forms will be maintained at the treatment plant for review by CDM Smith. If a final inspection for either a specific task or the entire project is required, this information will be provided on the Final Inspection Form (Appendix J). If the inspection process identifies a nonconforming condition, it will be documented, tracked, corrected, and closed-out in accordance with procedures detailed in Section 10.0. Refer to Table 9-2 for a summary of QC tests to be completed in addition to the DFW inspections.

10.0 Nonconformance and Corrective Actions

This section describes the responsibilities and methods to be used by project personnel to identify, control, and correct non-conformances. A nonconformance is defined as a deficiency or deviation in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate. Non-conformances can be associated with installed equipment, processes, items, materials, documentation, samples, analytical data and services that do not meet the subcontract specifications, plans, or other established requirements. Correction of non-conformances will be focused at determining the cause of the deficiency and instituting actions to correct the deficiency and prevent recurrence. Procedures for implementing changes to approved documents include Field Work Variances and Change Orders (refer to Section 12.0).

10.1 Nonconformance Identification

Non-conformances may be identified during field QC inspections, through informal surveillances of field activities, or at other times where field activities are being observed or evaluated. Arrowhead personnel or subcontractors who identify a nonconformance are responsible for immediately notifying the Site QCM or the PM. The Site QCM is then responsible for preparing a Nonconformance Report (NCR) (Appendix K) to describe and document the nonconformance. When immediate corrective action is required, that action will not be delayed for the processing of the NCR. The Site QCM, PM, and other project personnel will discuss the nonconformance to determine if it is properly described and that applicable project requirements have not been met to warrant issuance of the NCR.

10.2 Nonconformance Reports

Nonconformance Reports are used to document non-conformances found during QC inspections or other means. A NCR (Appendix K) will be generated upon encountering a nonconformance that cannot be immediately corrected or is of a repetitive nature. The NCR will include the following information:

- NCR identification number and date identified
- Responsible organization
- Detailed description of the nonconforming item or activity
- Cause of nonconformance

- Referenced criteria
- Recommended disposition/corrective action
- Disposition, verification, and date of corrective action

Nonconformance reports will be attached to the DQCR or Monthly O&M Report. Deficiencies, variations, test failures, and corrective actions proposed or taken as a result of the nonconformance will be documented in the DQCR or Monthly O&M Report.

Minor deficiencies or variations that do not warrant the preparation of a NCR or a FWV will be described and documented in the DQCR. The information provided will include the origin of the minor deficiency/variation (i.e. follow-up inspections), failed or out-of-control testing results (if applicable), corrective actions proposed or taken, a summary of instructions or communication with CDM Smith regarding the deficiency/variation, and other information or proposed actions as appropriate.

10.3 Nonconformance Disposition

Non-conformances determined to be valid will be issued to the responsible organization (subcontractor, supplier, or vendor) for disposition. Dispositions to non-conformances will require the responsible organization to identify the cause, corrective action, action to preclude recurrence, and the date when all corrective actions will be completed. Corrective actions will be approved by the Corporate QCM and the PM prior to implementation. Nonconformance Reports will remain on open status until the corrective actions have been implemented and verified as acceptable by the Corporate QCM.

Corrective actions implemented in the field to correct non-conformances will be documented in the NCR and DQCR. Corrective actions implemented by laboratories or off-site vendors or suppliers will be documented in writing and submitted to Arrowhead for approval.

Documentation used to support the decision to closeout the NCR will be attached to the NCR and will be included with the DQCR. Nonconformance reports closed-out after the completion of the field activities will be submitted to CDM Smith under separate cover.

10.4 Corrective Action Identification

When the Corporate QCM determines that a corrective action(s) for a nonconformance is appropriate and required, a Corrective Action Request (Appendix K) will be issued to the responsible organization. Generally, corrective actions will be required for all non-

conformances determined to be significantly adverse to quality in accordance with the following guidelines:

- Failure of the procedural system to produce the results specified in plans, procedures, specifications, and other project requirements
- Identification of repetitive nonconforming conditions for which previous corrective actions have been ineffective
- Repeated failure to comply with subcontract requirements, plans, and procedures
- Significant deficiencies found during the review or validation of data.

10.5 Corrective Action Request

Significant nonconforming conditions will be documented on the CAR and submitted to the responsible organization. Each CAR will specify:

- CAR identification number and date
- Responsible organization
- Nature of the nonconformance requiring corrective action (including the specific requirement or specification violated)
- Response due date
- Date of disposition
- Disposition and verification information
- Date corrective action is verified

10.6 Corrective Action Disposition

The CARs will require the responsible party to submit a written response, including:

- The steps that have been taken or will be taken to correct the condition reported in the CAR
- The cause that led to the condition reported in the CAR
- The steps that have or will be taken to preclude recurrence
- The dates when the indicated corrective action was or will be complete.

The response to the CAR will be evaluated by the Corporate QCM. Acceptance will be documented on the CAR and the date when implementation of the stated actions can be verified. Implementation of the corrective action, as stated in the response, will be verified by the Corporate QCM prior to closeout of the CAR. Unacceptable responses to CARs will be noted on the CAR and returned to the responsible organization to reissue the response. Failure to respond to CARs may result in the issuance of a Stop Work Order (SWO) by the Corporate QCM.

10.7 Stop Work Authority

The PM and Corporate QCM have the authority to stop or control further processing of activities that, in the opinion of the Corporate QCM, are uncontrolled or nonconforming and, if not corrected, could affect the quality of the project or jeopardize the accomplishment of project goals or result in significant rework. Stop work actions will be coordinated through the PM with input from Corporate CDM Smith. Stop work actions will only be implemented when conditions exist which cannot be resolved through the nonconformance system or normal construction processes. Conditions which threaten safety, health, the public, or the environment will be brought to the attention of the Site Health and Safety Officer (SHSO) for action, unless the conditions pose an immediate danger, whereby the work will be stopped immediately by the Site QCM, PM, Site Supervisor, SHSO, or individual responsible for the work being performed.

10.8 Stop Work Orders

Upon determination by the Site QCM that the criteria for a Stop Work Order (SWO) applies, the Corporate QCM and PM will be notified verbally. The Corporate QCM will then verbally notify the applicable organization of the intent to stop work, when the SWO becomes effective, and the activities to which the SWO applies. The SWO (Appendix K) will be issued in writing by the Corporate QCM to the PM and the applicable organizations. In addition, CDM Smith will be notified within two hours of an SWO.

The Corporate QCM, Site QCM, PM, and the responsible party will agree upon a corrective action plan and a date for implementation. The Corporate QCM and PM will sign the SWO signifying agreement with the corrective action required. The responsible party will implement the required corrective action, upon resumption of work activities, and notify the Site QCM when the corrective action has been completed. Upon verification of satisfactory correction of the nonconforming conditions, the Corporate QCM will cancel the SWO and give notice to the PM and the responsible party that normal operations may resume for that activity.

11.0 Change Control

During the course of field activities, it may become necessary to request approval to vary from approved plans or specifications. This section discusses the procedures for implementing changes to plans or specifications, including Field Work Variances (FWVs) and Change Orders.

11.1 Field Work Variance

Changes to approved plans, specifications, or O&M procedures may be required based on unanticipated field conditions or identification of improved methods or procedures. Requests to vary from approved documents will be submitted to CDM Smith using a Field Work Variance (FWV) (Appendix L). The FWV will be completed by the PM or Site QCM and will include the following information:

- Description of present work requirements
- Description of proposed change
- Technical justification/rationale
- Document(s) requiring change
- Cost and schedule impacts.

Field Work Variances will be submitted to the CDM Smith for approval within 24 hours of the time that the FWV was discussed with CDM Smith. Prior to submittal to CDM Smith, the completed FWVs will be reviewed by the Site QCM to verify that applicable quality requirements are incorporated. Approval of FWVs does not give the contractor authority to proceed with additional work. Rather, changes to the SOW, contract price, or project schedule will be approved through Change Orders in accordance Section 11.2. Upon approval of the FWV, CDM Smith may issue a Work Directive Change to Arrowhead. The Work Directive Change authorizes Arrowhead to proceed with the change or variance to the SOW prior to issuing a formal Change Order.

Minor changes/variance to the SOW can be implemented in the field prior to FWV approval from CDM Smith with verbal approval. Minor variances are defined as those variances that do not affect contract price, schedule, quality, or quantities. (In contrast, major variances initially require a Work Directive Change prior to implementation. Major variances have an impact on the contract price and project schedule and eventually are documented in Change Orders.) Upon approval of a minor variance, CDM Smith will issue a Field Order to Arrowhead. The Field Order authorizes Arrowhead to proceed with the minor variance to the SOW as described in the

FWV. A Field Order may also be used to interpret/clarify contract documents and/or document negotiated agreements.

11.2 Change Orders

Change Orders describe changes to the SOW, including an accounting of the adjustment in the contract price and/or project schedule. A Change Order will also contain revised contract documents/specifications to define the details of the change. Prior to a Change Order, CDM Smith may issue a Work Directive Change (refer to Section 11.1), which authorizes Arrowhead to proceed with a change for subsequent incorporation in the Change Order. Conversely, CDM Smith may begin the change order process by submitting a Request for Proposal (RFP) to Arrowhead. Change Orders shall be substantiated by a cost proposal from Arrowhead. The proposal shall include all necessary data (labor, equipment, products, taxes, bonds, overhead, profit, etc.) to support an adjustment to the contract price, as applicable. Proposals may be lump/sum fixed price, unit price, or time-and-materials as directed by CDM Smith. Change Orders will be processed in accordance with the specifications.

11.3 Change Documentation

Field Work Variances will be controlled and maintained in the record file system in accordance with the procedures outlined in Section 5.4. Approved FWV documents will be forwarded to controlled document holders. Changes to plans or documents as a result of implementation of FWVs will be incorporated into the affected plan or document during the next revision.

12.0 Subcontractor Control

This section describes the controls for ensuring that Arrowhead subcontractors comply with project QC requirements.

12.1 Subcontractor Requirements and Responsibilities

The Arrowhead PM, Corporate QCM, and Subcontracts Manager are responsible for identification of all technical and quality requirements included in subcontract agreements and POs. The requirements for personnel qualifications, technical performance levels, QC procedures, applicable specifications and standards, acceptability levels, and documentation will be included as a part of the subcontract/PO documents as discussed in Section 6.0. All subcontractors performing work on this project are responsible for compliance to the requirements of their respective subcontract/PO. Subcontractors are required to implement internal QC procedures to ensure that the items or services that they provide are in compliance with the subcontract/PO requirements.

12.2 Subcontractor Monitoring

Arrowhead has the overall responsibility for conformance to the quality requirements for subcontracted items and services. The Corporate and/or Site QCM are responsible for the implementation of inspections, document reviews, design review, and other QC activities for monitoring subcontractor performance relative to the subcontract specifications. Using these methods, Arrowhead will determine whether the subcontractor is complying with project QC measures, including:

- Meeting quality requirements
- Generating, controlling, and maintaining required documentation
- Performing and documenting required inspections and tests
- Identifying, reporting, and correcting nonconforming conditions

These activities will be documented on inspection forms, Monthly O&M Reports, and other forms as outlined in this CQCP. In addition, subcontractors working on-site will be required to document their daily work activities on a Subcontractor Daily Tracking Log (Appendix M) or equivalent form. The Subcontractor Daily Tracking Log will contain the following minimum information:

- Description of work performed by the subcontractor
- Manpower summary (name, trade, and hours worked)
- Heavy equipment used on-site
- Materials received or consumed
- Copies of applicable testing results

12.3 Subcontractor Noncompliance

Testing or other work performed by subcontractors that does not conform to specified requirements will be identified, reported, controlled, corrected, and tracked in accordance with Section 10.0. Notification of subcontractor nonconformance will be accomplished via the NCR. Notification will be provided as soon as the nonconforming work has been identified and jointly confirmed by the PM and Corporate QCM.

12.4 Subcontractor Corrective Actions

As necessary, corrective actions on the part of a subcontractor will be required by means of a CAR, issued by Arrowhead. Corrective actions implemented by subcontractors will be monitored and documented by the Corporate QCM or designee to verify that the subcontractor's performance meets the required specifications. The PM and Corporate QCM has the authority to stop work by subcontractors in accordance with Section 10.7.

13.0 Material Receipt and Inspection

This section describes the inspections that will be conducted upon receipt of items or materials to be used during construction of the groundwater extraction and treatment system. Receipt inspections will be conducted by the QCM or his designee to ensure compliance with the QC requirements set forth in the PO, including applicable design/construction specifications.

Receipt inspections for items purchased to support field activities (i.e., gloves, rental equipment, hand tools, and other items that are not associated with specific quality requirements) will be performed by the Procurement Administrator for verification of type and quantity.

13.1 Inspection

Upon receipt, the QCM, Procurement Administrator, or the inspector will examine the items or materials to ensure that they meet the quality requirements specified in the subcontract/PO. The inspector will compare the shipping documents (i.e., bill of lading, weight tickets, etc.) and the item or materials with the purchase order requirements and note any discrepancies in material specifications, schedules, thickness, sizes, make, model numbers, or other physical properties. Apparent damages or shortages will be noted on the Receipt Inspection Form (Appendix N) and the shipping documents and reported to the Procurement Administrator. Additionally, the shipment will be checked for the presence of the proper supporting documentation, such as factory test results, certificates of compliance, and mill certificates. Chemicals and other materials must be accompanied by Material Safety Data Sheets (MSDSs). Receipt inspections will not include operational or performance testing of items or components.

13.2 Rejection

The basis for rejection of shipments will be documented on the Receipt Inspection Form and shipping documents. The PM and Procurement Administrator will be notified that the shipment is going to be rejected and the basis for rejection. Items/materials will not be returned to suppliers or vendors without authorization from the PM or QCM.

13.3 Acceptance

If the items or materials meet the PO requirements and no visual deficiencies are observed, the QCM or inspector will document acceptance on the Receipt Inspection Form and release the item/material for use. The completed Receipt Inspection Form will be included in the DQCR. After items or materials have been inspected and approved for use, they will be released to the

Site Supervisor. The items or materials will be stored in a secure area to protect physical and operational characteristics from damage, deterioration, theft, or tampering. The Procurement Administrator will revise inventories as required.

13.4 Conditional Use

When supporting documentation is not provided with the shipment but the item otherwise meets the PO requirements, the QCM may issue a conditional release for the item. The conditional release will be temporary and will allow for use of the item contingent upon future receipt of the missing documentation. If requests for documentation are unsuccessful, the QCM will revoke the conditional release and notify the PM. The PM will resolve the documentation problem or an NCR will be issued to track the nonconformance.

14.0 References

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Tables

Table 2-1
Project Personnel and Responsibilities

Name	Telephone Number(s)	Responsibility
Mr. Thomas Mathew	(732) 590-4638 office	CDM Project Manager
Ms. Katelyn Reepmeyer	(518) 782-4570 cell	CDM Field Representative
Mr. Ali Rahmani	(732) 590-4727 office	CDM Project Engineer
Mr. Vernon Wimberley	(703) 968-0900 office	CDM Contracting Officer
Mr. Doug Ronk	(913) 461-3805 cell	Arrowhead Project Manager
Mr. Scott Siegwald, CIH	(913) 814-9994 office (913) 461-3804 cell	Arrowhead Corporate Health and Safety Officer
Mr. Bryant Kroutch	(913) 814-9994 office (913) 461-3809 cell	Arrowhead Corporate Quality Control Manager
Mr. Greg Wallace	(913) 814-9994 office (913) 461-3828 cell	Arrowhead Project Quality Control Manager
Mr. Joe Cotter	(913) 961-5257 cell	Arrowhead Site Supervisor
Mr. Clayton Nystrom	(254) 644-2822	Arrowhead Site Quality Assurance Officer /Designated Safety Coordinator

Table 9-1
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant Construction
Definable Feature of Work Inspection Log

Definable Feature of Work	Applicable Specification Section	Applicable QAPP Table	3-Phase Inspection Process			Notes
			Prepartory (Date Completed)	Initial (Date Completed)	Follow-Up (Date Completed)	
Clearing and grubbing	2100	NA				
Land Surveying	1550	NA				
Installation of erosion and sediment control features	2370	NA				
Yard piping trenching and installation	15200	NA				
Directional boring	2301	NA				
Site utility installation	16600	NA				
Effluent outfall manhole termination	15200	NA				
Extraction wellhead construction	15200	NA				
Extraction well pump installation	11319	NA				
Groundwater treatment system equipment installation	13300	NA				
Installation of secondary electrical service at southern well field	16375	NA				
Installation of electrical panel boards and motors control centers	16261, 16470	NA				
Installation of process control equipment	13405	NA				
Site grading and restoration	2300	NA				
Asphalt roadway construction/repair	2576	NA				
Fence installation	2821	NA				
System start-up and performance testing	1800	NA				
Chemical data acquisition	1800	18				
Operation and maintenance	1800, 1850	18				

Table 9-2
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant Construction
Quality Control Test Summary

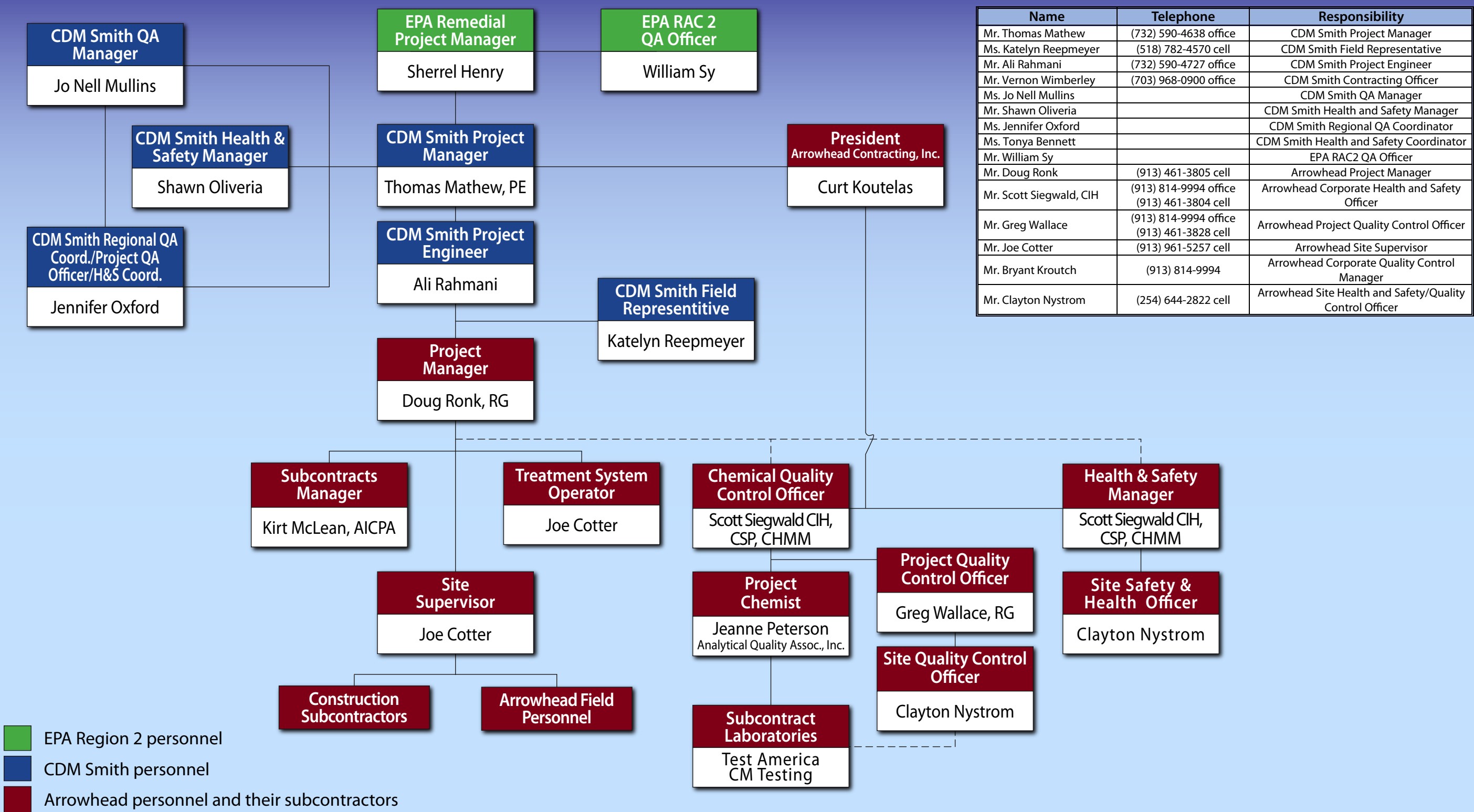
Test	Location	Applicable Specification Section	Applicable QAPP Table	Test Frequency	Responsible Party	3-Phase Inspection Process		
						Preparatory (Date Completed)	Initial (Date Completed)	Follow-Up (Date Completed)
Geotechnical soil testing	2 borings located near each end of direction bore.	2300	18	Continuous soil logging to 30' bgs	Arrowhead			
Backfill material certification	Material source.	2300	18	1 per 5,000CY	Test America			
Excess soil sampling	Onsite stockpiled excess soil	2300	18	TBD	Test America			
Standard proctor/grain size (import material)	Material source.	2300	18	1 per 500CY	CM Testing			
Standard proctor/grain size (site soils)	Onsite stockpiled soil	2300	18	1, see note 1.	CM Testing			
In-place soil density test (yard piping backfill)	Yard piping trench	2300	NA	1 per 200 linear feet per lift	CM Testing			
Yard piping pressure testing	Well SEW-1S	15200	NA	1	Arrowhead			
	Well SEW-1I	15200	NA	1	Arrowhead			
	Well SEW-1D	15200	NA	1	Arrowhead			
	Effluent discharge	15200	NA	1	Arrowhead			
Security system operation/function	Security panel, door switches, camera	13122	NA	1	Arrowhead			
Electrical testing	Secondary service voltage	16261	NA	1	Arrowhead			
	Secondary service phase balance	16261	NA	1	Arrowhead			
	VFD operation	16261	NA	1	Arrowhead			
	Circuit breaker operation	16402	NA	1	Arrowhead			
	GFCI operation	16402	NA	1	Arrowhead			
	Motor rotation	16220	NA	1	Arrowhead			
	Voltage at each device	16402	NA	1	Arrowhead			
	Phase balance at each 3-phase motor	16220	NA	1	Arrowhead			
	Ground testing - between phase and ground, each device	16600	NA	1	Arrowhead			
Control system operation/functionality testing	To be developed as design is completed	13405, 13410	NA	1	Arrowhead			
Initial Testing Program	48 hour test	1800	18	Varies by location	Arrowhead/Test America			
	14 day test	1800	18	Varies by location	Arrowhead/Test America			

Notes:

1. Additional proctor samples to be collected as requested by Site QCM.

Figures

Figure 2-1 Project Organization Chart - Old Roosevelt Field Superfund Site - RA Construction



Appendix A
Quality Control Authorization Letter



October 1, 2014

RE: Site Quality Control Manager
Old Roosevelt Field Superfund Site Remedial Construction Services
CDM Subcontract No. 3320-048-001-CNS

To Whom It May Concern:

This Letter of Direction authorizes Mr. Clayton Nystrom to act as the Site Quality Control Manager on the above referenced contract. He is authorized to perform all duties outlined in the attached project Quality Control Plan.

Mr. Nystrom will be responsible for preparing and maintaining the Submittal Register From 4288 for the duration of the project. He will also be responsible for review and approval of all submittal documents to ensure compliance with applicable specifications, drawings, and to the quality of materials proposed for use. This applies to all subcontractors, offsite fabricators, and suppliers. He will be responsible for reviewing all test data for compliance with applicable specifications.

Sincerely,

A handwritten signature in dark ink, appearing to read "B. Kroutch", is written over a light gray rectangular background.

Bryant Kroutch, PE
Corporate Quality Control Officer

Appendix B
Quality Control Personnel Resumes

Bryant Kroutch, PE
CORPORATE QUALITY CONTROL MANAGER

ARROWHEAD CONTRACTING, INC.

TOTAL YEARS EXPERIENCE: 25

EXPERIENCE WITH OTHER FIRMS:

1990–1999, IT Corporation

1986–1990, ICF Kaiser

Engineers

PROFESSIONAL REGISTRATION:

PE IN WASHINGTON & KANSAS

EDUCATION:

Montana College of Mineral
Science and Technology: BS,

Petroleum Engineering, 1985

PROFESSIONAL REGISTRATION:

PE, Kansas and Washington

QUALIFICATION HIGHLIGHTS:

- ◆ 25+ years experience managing General Construction and HTRW contracts
- ◆ Managed up to 20 concurrent TOs ranging in value from \$25K to \$2.5M.
- ◆ Experience managing FFP, CPFF and T&M TOs.
- ◆ Project/construction manager/CQC manager for a diverse resume of general, civil and environmental construction projects.
- ◆ Well rounded experience including program and project level management of construction services and Construction Quality Control

RELEVANT PROJECT EXPERIENCE

Mr. Kroutch is a registered Professional Engineer with 25 years of experience in successfully managing and performing multi-faceted, cost-reimbursable and firm-fixed-price, turnkey programs and projects for the federal government and commercial clientele. As Arrowhead's Quality Control Principal, Mr. Kroutch participates in the direction and oversight of all Arrowhead general and remedial construction endeavors.

Program Construction/CQC Manager, Guardian Installation Protection Program. As a fully integrated team member for this FFP, ID/IQ contract, under Mr. Kroutch's direct oversight, Arrowhead worked closely with the prime contractor during the early planning stages of the Task Order to provide constructability reviews, develop submittal registers, quality control requirements and jointly established a master construction schedule. Ongoing projects under this program entail a variety of traditional vertical and horizontal MILCON type construction service and a broad range of CBRN detection systems and Command, Control, Communication, Computers and Intelligence (C4I) equipment. Arrowhead has executed 84 design or construction task orders totaling in excess of \$23 million at 100 military facilities.

Program Construction Manager/CQC Manager, NOAA Central Region and NOAA Western Region Construction MATOCs. Construction/CQC Manager for Arrowhead's ongoing role under two, five-year, nationwide ID/IQ program for design-build, general construction services at nationwide, NOAA facilities. To date over \$8M in Task Orders encompassing a wide range of new construction and renovation services including emergency response to repair facilities in the Gulf Coast following Hurricane Katrina. Task Order projects ranged from \$3200K to \$1.7M.

CQC/Construction Manager, Hastings, NE - Blaine NAD, USACE. Provided engineering/construction services in support of CERCLA remedial investigation, remedial design, and operations of remedial systems. Responsibilities included: subcontracting, health and safety, QC, invoicing, vendor payments, site investigations, engineering design, construction, public relations, and project closeout. Remedial construction under his direction included five soil vapor extraction systems, an enhanced bioremediation/air sparging system for groundwater, an engineered landfill cover, and several excavation/site restoration plans.

Engineering/QC Manager, FUSRAP, Madison Site (PRAC), USACE. Managed the surface decontamination and removal of 60,000-pounds of uranium-contaminated dust from overhead structures within a large, 130,000-square-foot, extrusion press facility. Conducted an accessibility study and designed two working platforms that were constructed on top of existing overhead cranes to provide workers unencumbered access to the overhead structures.

Construction/QC Manager, St. Louis Downtown FUSRAP Site, USACE. Oversight of management and transportation services at a large, complex FUSRAP site under the direction of the USACE St. Louis District. Managed the storage, loading, and transporting of Class 7, 9, and exempt LLRW. The scope included successfully transporting over 70,000 tons of LLRW from the St. Louis Downtown FUSRAP Site to various disposal facilities throughout the Western United States.

PROJECT SITE SUPERINTENDENT
Joe Cotter

ARROWHEAD CONTRACTING, INC.

TOTAL YEARS EXPERIENCE: 7

EDUCATION

Southwest Missouri State University,
BS, Industrial Management, 2003

PROFESSIONAL REGISTRATION

CQM Certification, USACE

OSHA 40-Hour Hazardous Waste
Activities Training

OSHA 8-Hour Refresher for
Hazardous Waste Activities

REGULATORY KNOWLEDGE

RCRA, CERCLA, OSHA, DOT –
Various State, Federal, Local regs;
EPA Regions: 3, 6, 7, 8

QUALIFICATION HIGHLIGHTS

- ◆ Significant field QC experience on USACE led construction projects.
- ◆ Diversity of ID/IQ, remedial, civil and general construction projects primarily for federal agencies and/or private sector clients

DEMONSTRATED PERFORMANCE RECORD

- ✓ USACE CQC field managed QA/QC program/project activities on Superfund and general construction and homeland security sites
- ✓ Diversity of highly successful clean/remediation construction oversight projects

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Mr. Cotter is a Construction Superintendent/CQC Manager with over seven years of experience under a variety of civil/general construction projects for federal agencies. Duties include a variety of site construction and QC functions depending on project requirements. Typical responsibilities include review of subcontractor proposals and contracts for compliance with regulations; preparation of work plans, cost estimates, and project schedules; requisition of equipment and materials; performance of QA/QC inspections, preparation of reports, supervision of subcontractors/suppliers and coordination with a variety of project stakeholders. Mr. Cotter maintains a comprehensive understanding of government procurement, subcontract administration, property management, and contract administration procedures.

Site Superintendent, Guardian Installation Protection Program, (2005-present). Ongoing projects under this program entail a variety of traditional vertical and horizontal MILCON type construction service and a broad range of CBRN detection systems and Command, Control, Communication, Computers and Intelligence (C4I) equipment. Mr. Cotter has participated in a significant portion of Arrowhead's design or construction task orders totaling in excess of \$23 million at 100 military facilities nationwide and internationally.

Site Superintendent/CQC Manager, N. Penn Area 7 Superfund Site, OU-2, North Wales, PA (2009). Quality Control Manager for a \$1.6M, firm fixed-price soil remedial action. Included surgical excavation, demolition, unforeseen contamination accommodations surrounding subsurface contamination. Included pre-excavation subsurface characterization that facilitated efficient excavation/live loading of soils and discovery of unknown conditions. Site restoration activities included backfilling and grading site to ensure compliance with stormwater management plan.

Site Superintendent/CQC Manager, NWIRP Remediation, Dallas, TX (2007-2008). Project included permeable reactive groundwater barrier installation, landfill cap construction, treatment cell upgrades, demolition of surface/subsurface structures, and soil remediation at a facility spanning nearly 10,000 acres. Site restoration activities included backfilling and grading site to ensure compliance with stormwater management plan.

Site Superintendent/CQC Manager, Naval Air Station, Kingsville, Texas (2007). Managed field remediation construction services associated with a UST removal and remediation effort that included the excavation, dewatering and temporary treatment of contaminated groundwater. Contaminated soils were staged and bioremediated for later use in site restoration. A total of 13,000 cy of clean soil was excavated and stockpiled and a total of 17,000 cy of petroleum contaminated soil was bioremediated ex-situ.

PROJECT QUALITY
Greg Wallace, RG

CONTROL OFFICER

ARROWHEAD CONTRACTING, INC.

Total Years Experience: 26

EDUCATION

Colorado State University: B.S.,
Geology, 1983

PROFESSIONAL REGISTRATION

RG in KS and MO

QUALIFICATION HIGHLIGHTS

- ◆ Is responsible for oversight and management of eight projects with CDM
- ◆ Mr. Wallace is a nationally recognized expert in the design, construction, and operation of groundwater treatment systems. He has been recognized for his technical accomplishments with a number of prestigious awards including the President's Design Award, the USACE Grand Award for Engineering Excellence, the USACE Engineering Excellence Award, and the Chief of Engineers' Design Honor Award

EXPERIENCE WITH OTHER FIRMS

1998-2000, URS Corp., PM,
1987-1998, Woodward Clyde, PM
1985-1987, Black & Veatch, PM
1983-1985, Denver Water Board,
PM

REGULATORY KNOWLEDGE

RCRA, CERCLA, TSCA, SWDA,
NPDES, CAA, CWA, DOT – Various
State, Federal, and Local; EPA
Regions: 2, 3, 4, 5, 6, 7, 8, 9

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Program Manager, Tutu Wellfield, Region 2, Superfund Site, St. Thomas Virgin Islands (2003 to ongoing O&M). Design-build contract to build two groundwater remediation systems and one SVE system. Arrowhead prepared a detailed design package and implemented a Remedial Action (RA) at the Tutu Wells Superfund Site. The RA includes cleanup of the source soils and site-wide groundwater. Groundwater cleanup includes the installation of recovery wells to contain the spread of groundwater contamination, and construction of two treatment facilities to treat the extracted groundwater. In-situ SVE treatment addresses areas of concern, source soils. Principal components of the construction included nine new wells, two concrete process-buildings featuring the Royal Building System, earth retaining structures, yard piping, concrete equipment pads, process equipment, systems controls, and site restoration. Arrowhead is now in the fourth year of Operation and Maintenance at the site.

Program Manager, Mead NOP Superfund, Mead, NE, CENWD, (2006-2010). Managed the design, installation, and prove-out of three, separate, competitively bid, TCE contaminated groundwater treatment system(s) at the former Mead Naval Ordnance Plant (NOP). The design/construction components included water treatment plant buildings, process equipment, and site preparation. Technology included hydraulic control/air stripping and Advanced Oxidation Processes to treat contaminated groundwater.

Project Manager, 10th Street Superfund Site, Columbus, Nebraska

Mr. Wallace was the Project Manager for a \$1.72 Million design-build firm fixed fee contract by CDM Federal Programs Corp. to construct a groundwater extraction and treatment system (GETS) as an Interim Remedial Action at the 10th Street Superfund Site (Operable Unit 2) in Columbus, Nebraska. The GETS constructed by Arrowhead is comprised of four extraction wells, over 3,500 feet of HDPE interconnecting piping, operates at a design flow rate of 1500 gpm, and provides on-site treatment utilizing air stripping technology. The design incorporated a fiberglass equalization tank to receive water from all of the extraction wells, filtration equipment for pre-treatment, chemical addition of sequestrant to enhance the finished product (as well as reduce the potential for fouling of the air stripper), and a unique discharge system design that allows the City the flexibility to accept 0 to 100% of the treated water flow to the City water supply.

Program Manager, Mead Superfund NOP, Mead, NE Program Manager for design, installation, and prove-out of a TCE contaminated groundwater treatment system at the former Mead Naval Ordnance Plant (NOP), Mead, Nebraska.

Project Manager, Vienna PCE Superfund Site, WV, (2004-2005). Program Manager for design and construction of four air sparge/soil vapor extraction systems involving over 100 sparge points and 22 SVE points. The project also includes two pre-engineered metal wastewater process buildings, two prefabricated wastewater process buildings, 37,000 linear feet of sparge lines, 13,000 linear feet of SVE lines, and over 4,000 linear

Program Manager, Celotex Superfund Residential Removal, Chicago, IL (2007). Managed this time-sensitive, highly complex, contaminated soil removal action in a high-density, residential neighborhood in downtown Chicago. Continuous, ad-hoc field engineering and innovation was necessary to keep the project on track and schedule. Close coordination with the project and the community stakeholders was integral to this highly successful project.

Program Manager, McGregor NWIRP, Navy, McGregor, TX, (2003 – 2005). Managed excavation, treatment and disposal of approximately 6,250 cy of perchlorate-, metals-, and VOC-impacted soils, located at 15 buildings. This project was a three-phase, multi-media project requiring: removal, treatment, and disposal, passive bio-trench and bio-borings and installation of additional bio-trenches and closure of onsite landfills.

Program Manager, Multiple Award Task Order Contract, USACE.

Program Manager for Arrowhead's \$15M, 3-year FFP, ID/IQ, design-build contract with the USACE, Kansas City District to execute general construction Task Orders throughout the Central U.S.

Program Manager, USACE Kansas City District, Pre-Placed Remedial Action Contract.

Five-year ID/IQ program executing remedial action task orders throughout the Central U.S. Included both cost-reimbursable and fixed-price projects.

Program Manager, USEPA, Region VIII, Small Business RAC.

Program Manager for Arrowhead's \$3M, five-year -duration, ID/IQ contract with the USEPA to perform site investigations and execute resulting remedial action at abandoned UST sites throughout the Western and Central U.S.

Project Manager, St. Louis Army Ammunition Plant, St. Louis, Missouri

Project Manager for the investigation and remediation of PCB contamination at the St. Louis Army Ammunition Plant. This project represents a \$6.3 million delivery order under Arrowhead's PRAC with the USACE, Kansas City District and includes the removal and disposal of 1,121 tons of concrete flooring from within an old production facility, removal of 866 tons of contaminated soil and waste materials from around the production building footprint, demolition of a 170,000 square foot, three story building structure, and removal of over 1,000 tons of contaminated soil beneath the building footprint.. Strict waste characterization, compliance with TSDF regulations and requirements was critical to the success of this fast track, mission critical project.

Program Manager, USACE Kansas City District, Pre-Placed Remedial Action Contract.

Five-year ID/IQ program executing remedial action task orders throughout the Central U.S. Included both cost-reimbursable and fixed-price projects.

Environmental Technical Lead and Project Manager, U.S. Army Corps of Engineers, Total Environmental Restoration Contract (TERC).

Environmental Technical Lead and Project Manager for Arrowhead's ongoing role under a \$270M, 10-year cost-reimbursable ID/IQ contract. Arrowhead is a contractual team member; under a large-business led consortium that was awarded this contract from the USACE, Kansas City District. The scope of services provided through this contract involves the life-cycle environmental restoration of impaired federal properties and associated general construction. To date, Arrowhead has been awarded 17 subcontract task orders ranging in value from \$5K to \$3.5M. The aggregate value of all task orders to date exceeds \$12M. Representative experience under this contract includes:

- **Blaine NAD Superfund Site, Hastings, Nebraska, (CENWD)**

Project Manager for characterization, remedial design, and remediation activities at the former Blaine NAD. Projects were conducted under a Site Specific ID/IQ Contract with USACE KC. Example task orders included development of regional fate and transport groundwater model; design, construction, and operation of the Multiple Technologies Facility (MTF) to conduct pilot studies of deep horizontal air sparging techniques and enhanced bioremediation; Remedial Investigation (RI) of 7 square miles of VOC plumes and 4 square mile of explosive plumes; RI of soil contamination in 9 square miles of production facility areas; design of Soil Vapor Extraction Systems; and, annual groundwater sampling of hundreds of monitoring wells. Representative documentation included Sampling and Analysis Plans; Safety, Health, and Emergency Response Plans; Quality Control Plans; Technical Memoranda; RI Reports; Preliminary Contamination Assessment Summaries; Feasibility Studies; Engineering Evaluation and Cost Analysis; Proposed Plans; Record of Decision; Removal Action Work Plans and other design documents; and, Construction Summary Reports. Community involvement included regular participation in RAB Meetings.

PROJECT MANAGER
Doug Ronk, RG

ARROWHEAD CONTRACTING, INC.

TOTAL YEARS EXPERIENCE: 11

EDUCATION:

Southern Illinois University at Carbondale,
M.S., Geology, 2003
Northwest Missouri State University, B.S.,
Geology, 1997

PROFESSIONAL REGISTRATION:

RG in Washington
US National Domestic Preparedness
Program Emergency Responder Nuclear,
Biological, and Chemical Responder
Operations

QUALIFICATION HIGHLIGHTS:

- ◆ 8 years experience managing ERS and HTRW contracts
- ◆ Managed up to 5 concurrent TOs over a wide Program geography
- ◆ Experience managing FFP, CPFF and T&M TOs
- ◆ Developed and implemented innovative pre-excavation sampling programs for live loading vs. staging – resulting in significant cost avoidance for client(s)

FEDERAL AND STATE REGULATORS

Worked closely with the client, USEPA R8, and the USFS to resolve numerous unforeseen conditions and address environment-ally and archeologically sensitive areas potentially impacted by site work

UTILITIES

Coordinated with numerous western-US city engineering departments/utility groups relative to drilling programs associated with investigative/ remedial activities under a Small Business RAC, Region 8

DEMONSTRATED PERFORMANCE RECORD:

- ✓ Performed as Project Manager, Site Manager, Site Safety Officer at numerous, diverse ERS sites
- ✓ Excellent record of Stakeholder management and communication

EXPERIENCE WITH OTHER FIRMS: N/A

REGULATORY KNOWLEDGE:

RCRA, CERCLA, TSCA, SWDA, NPDES, CAA, CWA, – Various State, Federal, and Local; EPA Regions: 2, 3, 4, 5, 6, 7, 8, 9

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Project Manager, Lawrence Aviation Superfund Site, Port Jefferson Station, New York (2010). Managed the performance-based, design, construction and operation contract for a groundwater extraction and treatment facility (GWTF); and, the implementation of an in-situ, chemical-oxidation (ISCO) remediation technology at a 42 acre TCE soil and groundwater contamination site.

Project Manager, Mead NOP Superfund, Mead, NE, CENWD, (2006-2010). Managed the design, installation, and prove-out of three, separate, competitively bid, TCE contaminated groundwater treatment system(s) at the former Mead Naval Ordnance Plant (NOP). The design/construction components included water treatment plant buildings, process equipment, and site preparation. Technology included hydraulic control/air stripping and Advanced Oxidation Processes to treat contaminated groundwater.

Project Manager, Colorado Crystal/Northrop Grumman, Loveland, Colorado (2009) – Design/build of a water treatment system/building at an active manufacturing facility to treat TCE contaminated groundwater and soil via nine SVE wells and six dual-phase extraction wells. The groundwater was treated to accommodate discharge permit limits via a low profile air stripper prior to formation injection.

Project Manager/Lead Field Geologist, Small Business RAC USEPA Region 8 (2006-2007). Project Manager for U.S. EPA's \$5 million contract to remediate LUST sites in the southwest US. Field efforts included completion of multi-phased site assessments, investigative drilling programs, contaminant sampling, natural attenuation evaluations, and performance of various remedial measures for contaminated soil/ groundwater.

Site Manager, Vienna PCE Superfund Site, West Virginia (2004-2005). Site Manager for the constructability evaluation and field construction of four, air sparge/soil vapor extraction systems involving over 100 sparge points and 22 SVE points. The project included two, pre-engineered metal process buildings; two, prefabricated process buildings, 37,000 LF of sparge lines, 13,000 LF of SVE lines, and over 4,000 LF of trench installed within an active commercial/residential districts.

Project Manager, Rimini Community Waste Water Treatment System, Rimini, Montana (2005-2006). Site Manager for the installation of a new wastewater treatment system and remediation of contaminated soils in the Upper Ten Mile Creek Mining Area site located in Rimini, Montana. As part of the Remedial Action, activities include excavation, management, and disposition of arsenic- and lead-contaminated soil, construction of a new bridge, a 48,000 gal. septic tank, a four inch dia. force main, a sanitary sewer main; and, installation of a 20,000 gal. treatment tank and construction of control buildings.

Asst. Project Manager, St. Louis Army Ammunition Plant, St. Louis, MO, USACE CENWD, (2000-2004). Fast-track, technically-challenging remediation including the excavation/removal and disposal of over approximately 7,500 tons of PCB contaminated concrete, soil, and waste and abatement of asbestos-containing materials. Responsible for material load-out, piping and utilities removal, demolition, pre-TSDF characterization sampling and testing, excavation and backfill operations, and waste transportation and disposal.

SUBCONTRACTS MANAGER**ARROWHEAD CONTRACTING, INC.****Kirt McLean****TOTAL YEARS EXPERIENCE:** 23**EDUCATION:**

University of Missouri, Kansas City, 1989,
MS, Accounting (Tax Focus)
University of Missouri, Columbia, 1972, BS,
Engineering

PROFESSIONAL REGISTRATION:

◆ AICPA, MO Society of CPAs

QUALIFICATION HIGHLIGHTS:

- ◆ 23 years Federal and private sector finance, contract management, procurement experience; in depth knowledge of DFAR and AFAR.
- ◆ Significant experience with FFP and cost reimbursable (CPAF, CPIF, and CPFF) contracts.
- ◆ Provides internal and external Financial Management Training seminars for Project Managers.

DEMONSTRATED PERFORMANCE RECORD:

- ✓ Integral in the continued success and performance of numerous, Federal Contracts and Programs.

EXPERIENCE WITH OTHER FIRMS

July, 2007 – Present Arrowhead Contracting, Inc., Lenexa, Kansas, CFO
March, 2000-June, 2007, Larkin Group, Kansas City, Missouri, Controller
July, 1998-March, 2000, Tnemec Company, North Kansas City, Missouri, Operations Accountant and Property Manager
Jan to July, 1998, Acoustic Development Corp., St. Joseph, Missouri, Manager of Cost Accounting
1996-1998, R. Kirtley McLean, CPA, St. Joseph, Missouri, Management Consultant
Cargill & McLean, CPA's, St. Joseph, Missouri, Partner, 1989-1991
1972-1986, Carnation Company, St. Joseph, Missouri, Department Manager

PAST PERFORMANCE PROJECT INVOLVEMENT:

Projects 4, 5, and 6

RELEVANT ARROWHEAD PROJECT EXPERIENCE

Director of Accounting/Contracting, Arrowhead Contracting, Inc., (2007-present). Manages corporate accounting and contracts/subcontractor compliance for all company business. Duties include ensuring compliance with applicable Federal, regulations and policies, as well as the contract terms and conditions; maintaining MIS/purchasing system, includes overseeing procurement of subcontractors, national supplier/rental agreements.

Contracts Manager, Statewide MATOC, Missouri National Guard (2008 to present). Contract and Procurement administration functions under the 5-year Program to perform maintenance, renovation, construction and design/build services in support of MNG facilities, statewide.

Contracts Manager, MATOC - Levee Breach Repairs, USACE St. Louis District, (2008 – present). Responsible for Contract /Procurement functions under the \$3.5M, Multiple Task Order levee restoration/construction project. Managed Subcontractor procurement program and database for fast-track response to critical levee repair task orders.

Contracts Manager, MATOC, U.S. Fish and Wildlife Service, Region 3 (2007-present). Responsible for ensuring corporate compliance with contractual terms & conditions, and the FAR/DFAR for the 5-year Program to provide diverse design-build general/environmental construction.

Contracts Manager, MATOC, NOAA-Central Region, (June 2007 – present), Contract and Procurement administration functions under the 5-year Program for design-build, general/remedial construction services at NOAA facilities, nationwide. Program included significant subcontractor management and creative supply chain management because of disaster challenges.

Larkin Group, Kansas City, Missouri, March, 2000-June, 2007, Controller Report to the president and responsible for finance, administrative, and IT functions of a civil engineering firm. Streamlined general ledger and improved timeliness of financial reports. Worked with bank to extend line of credit with improved terms. Established new legal relationship. Planned the lay-out, build-out and move to new office space for the firm. Administrator for 401k plan. Provide financial management training for project managers. Review client and sub-consultant contracts. Implemented cash forecasting system. Direct accounting/administrative staff of four people and IT staff of one.

Tnemec Company, North Kansas City, Missouri, July, 1998-March, 2000, Operations Accountant and Property Manager

Maintained the fixed asset system. Coordinated independent auditor fieldwork in inventory, fixed assets and tax. Member of the Vice-President, Operations management team. Aided operating departments in preparation of operating and capital budgets. Appointed controller of a wholly owned subsidiary in addition to ongoing responsibilities.

Acoustic Development Corp., St. Joseph, Missouri, Jan to July, 1998, Manager of Cost Accounting

Directed the cost accounting efforts for the \$13 million manufacturing facility. Additional responsibilities included fixed asset management, serving as tax liaison with the independent auditors, and coordinating the installation of a new pc-based manufacturing/accounting software system (replacing JDEdwards system).

Appendix C

Training Forms

TRAINING ATTENDANCE RECORD

Appendix D
Daily Quality Control Report



Daily Quality Control Report

REPORT NO. 1 SUBCONTRACT NO. 3320-048-001-CN Date:

LOCATION OF WORK: Old Roosevelt Field Contaminated Groundwater Area Superfund Site,
Garden City, New York

DESCRIPTION OF WORK:

WEATHER CLASSIFICATION:

Class A	No interruptions of any kind from weather conditions occurring on this or previous shifts	Classification:
Class B	Weather occurred during this shift that caused a complete stoppage of work	Class: A
Class C	Weather occurred during this shift that caused a partial stoppage of work	Temperature
Class D	Weather overhead excellent or suitable for work during shift. Work completely stopped due to results of previous adverse weather.	Max 79°F Min. 65°F
Class E	Weather overhead excellent or suitable during shift but work partially stopped due to previous adverse manner.	Precipitation: None
Other	Explain:	Inches: 0.00"

- 1. Work Performed Today by ACI:**
- 2. Work Performed Today by Subcontractors:**
- 3. Location(s) of Work:**
- 4. List Type and Location of Tests Performed and Results of These Tests:**
- 5. Type and Results of Inspection: (include Satisfactory Work Completed or Deficiencies with Action to be taken).**
- 6. Location and Description of Non-Conformance and Corrective Actions:**
- 7. Instructions or Work Directives Received:**

8. Submittals Received and Reviewed:

9. Field Change Orders:

10. Remarks:

11. Safety Violations Observed:

12. Green Remediation:

13. CERTIFICATION: I certify that the above report is complete and correct and that I, or my authorized representative, have inspected all work performed this day by the contractor and each subcontractor and have determined that all materials, equipment, and workmanship are in strict compliance with the plans and specifications, except as may be noted above.

Site Quality Control Manager

Appendix E
Monthly O&M Report

**MARCH 2014 MONTHLY OPERATIONS AND MAINTENANCE SUMMARY
OLD ROOSEVELT FIELD SUPERFUND SITE
GARDEN CITY, NEW YORK**

**CDM Federal Programs Corporation
Subcontract No.
3320-048-001-CN**

Submitted to:

**CDM Federal Programs Corporation
110 Fieldcrest Ave. 6th Floor
Edison, New Jersey 08837**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher Drive
Lenexa, Kansas 66219**

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F	Year Two System Summary

List of Acronyms

Arrowhead	Arrowhead Contracting, Inc.
CDM Smith	CDM Federal Programs Corp.
CFM	cubic feet per minute
EW	Extraction Well
°F	Degrees Fahrenheit
g/mol	gram per mol
GAC	Granular Activated Carbon
gph	Gallons per hour
gpm	Gallons per minute
in.H ₂ O	inch of water
kWh	Kilowatt hours
LAI	Lawrence Aviation Industries
lb/day	pound per day
µg/l	micrograms per liter
mg/l	milligrams per liter
NC	Not collected
NS	Not Sampled
O&M	Operation and maintenance
PLC	Programmable logic controller
ppbv	part per billion per volume
ppm	parts per million
PSI	pounds per square inch
SPDES	State Pollution Discharge Elimination System
SU	Standard Unit
TAL	Target Analyte List
TCL	Target Compound List
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
U	Analyzed for but not detected
VOC	Volatile Organic Compound

1.0 Introduction

This report summarizes Operation and Maintenance (O&M) activities for the groundwater treatment system at the Old Roosevelt Field (ORF) Superfund Site located in Garden City, New York during the month of March 2014. This document was prepared by Arrowhead Contracting, Inc. (Arrowhead) for CDM Federal Programs Corporation (CDM Smith) under Subcontract No. 3320-048-001-CN.

2.0 Operation Activities

The system operated throughout the month of March using the three extraction wells. Wells EW-1S, EW-1I, and EW-1D operated at an average of 192 gallons per minute (gpm) this reporting period. No significant operation problems were noted during this period.

2.1 Operation Review

During the reporting period, 8,561,576 gallons were extracted and treated via air stripping with discharge routed to stormwater basin #124. The plant operated this period with zero hours of planned shutdown time and zero hours of unplanned shutdown time resulting in operation 100% of the month. Refer to Table 2-1 for a summary of plant operation and Appendix A for the control system data summary.

2.2 Planned Shutdowns

There were zero planned shutdowns totaling zero hours for the month of March.

2.3 Unplanned Shutdowns

There were no unplanned shutdowns this month.

3.0 Compliance Sampling

Sampling conducted this month consisted of the routine bi-monthly water samples and the monthly air sample. All water samples were submitted to the EPA Region 2 laboratory for analysis while the air sample was submitted to the project subcontract laboratory, Test America located in Burlington, Vermont.

3.1 Sampling Activities

Monthly O&M water samples were collected on March 12th and 26th. Per the SPDES permit equivalent, samples are collected for selected parameters twice per month, while samples required for monitoring system performance were collected once per month. A summary of the sample frequency and analyte list from each applicable sample location can be found in Table 3-1. The complete analytical data package for water samples can be found in Appendix C with the permit equivalent analyte results summarized in Table 3-2. Water quality measurements taken during each sampling event are attached in Appendix D.

An air sample was collected from the air stripper discharge on March 26th. The table below summarizes the VOC's detected; the complete analytical data package from the air sampling can be found in Appendix B.

Location	Constituent	Effluent Air Concentration (ppbv)	Molecular Weight (g/mol)	Air flow Rate (CFM)	Emissions Rate (lb/day)
Air Stripper Effluent	Dichlorodifluoromethane	12	120.91	2,400	0.01279
	Trichlorofluoromethane	23	137.37	2,400	0.02786
	1,1-Dichloroethene	3.6	96.94	2,400	0.00308
	Methyl tert-butyl ether	3.6	88.15	2,400	0.00280
	cis-1,2-Dichloroethene	9.5	96.95	2,400	0.00812
	Tetrachloroethene	85	165.82	2,400	0.12429
	Trichloroethene	120	131.38	2,400	0.13902

3.2 Data Summary

Review of analytical data from bi-monthly compliance sampling indicates the plant met the discharge requirements for all regulated VOCs and applicable metals. Wet chemistry parameters were met for all parameters excluding Total Suspended Solids (TSS), which in the Week 2 sample was 220mg/l. The permit equivalent limit for TSS is 50mg/l. The combined influent

sample collected during Week 2 sampling contained 210mg/l TSS; the cause of the elevated TSS value for influent and effluent samples is unknown, and as the system is currently configured there is not a capacity to remove TSS to meet the permit equivalent level.

Data validation was completed by EPA Region 2 laboratory on all water samples, with qualifiers added as required. The additions of qualifiers to data by EPA during data validation are not detailed in their report but the case narrative for the laboratory report did not contain any comments or changes in reporting limits to samples related to the O&M sampling.

Operating parameters not monitored by the programmable logic controller (PLC) were collected on a weekly basis with the data summarized in Table 3-3.

4.0 Maintenance Activities

All maintenance performed during this period was within the Scope of Work and consisted of routine maintenance activities. No routine maintenance was performed during March.

5.0 Operational Problems Encountered and Remedies

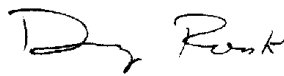
On March 10th the treatment plant OIT began experiencing errors related to display of various data fields of real-time information (tank level, pumping rates, etc.). The plant Operator restarted the OIT which appeared to resolve the issue. The PLC continued to control all automated operations without system interruption; the error appeared to be limited to data transfer between the PLC and OIT. No further problems were noted by the operator until March 20th, when the OIT again experienced the same error. Troubleshooting by the Process Engineer found data logs generated by the PLC for various parameters were not being recorded on an irregular basis and communication with the OIT was inconsistent. Consultation with the PLC manufacturer, Allen Bradley, confirmed that a failing PLC control module is most likely the source of all errors observed. Through the end of this reporting period the system was operating normally but if future errors occur a replacement of the PLC control module will be necessary.

6.0 Health and Safety

All work was done according to the project health and safety plan. No injuries or reported incidents occurred during the reporting period.

Operators Verification: On behalf of Arrowhead Contracting Inc., I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

Doug Ronk:



Project Manager



Table 2-1
Old Roosevelt Field Superfund Site
Groundwater Treatment System
Operation Summary
March 2014

Item	January 2014	February 2014	March 2014	2012 Total*	2013 Total**	Cumulative	Notes
Calendar days in period	31	28	31	366	365	821	
Treatment Plant							
- Run time hours	737	672	744	7883	8540	18576	
- Uptime %	99%	100%	100%	89.74%	97.49%	94.28%	
Treatment System Downtime (hours)							
- Planned	0	0	0	562	1	563	
- Unplanned	7	0	0	339	219	565	
Well IW-1D							
- Gallons extracted	4,239,216	3,867,736	4,281,728	37,098,085	48,111,072	97,597,837	
- Average Flow (gpm)	96	96	96	109	96	101	
Well IW-1I							
- Gallons extracted	2,119,616	1,933,872	2,139,924	17,557,370	24,188,634	47,939,416	
- Average Flow (gpm)	48	48	48	58	47	51	
Well IW-1S							
- Gallons extracted	2,119,612	1,933,868	2,139,924	24,729,681	23,870,750	54,793,835	
- Average Flow (gpm)	48	48	48	57	47	52	
Combined Influent							
- Gallons extracted	8,478,444	7,735,476	8,561,576	79,385,136	96,170,456	200,331,088	
- Average Flow (gpm)	192	192	192	224	190	204	

Legend:

gpm - gallons per minute

NA - Data not available

*Refer to Appendix E for the year one system summary.

**Refer to Appendix F for the year two system summary



Table 3-1
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant
Monthly Sampling Summary

Location	Sample Analysis															
	TCL VOC's (SOM0.12)		TAL Metals and Mercury (ISM01.3)		TSS (2540D)		TDS (2540C)		Oil and Grease (1664a)		Nirate and Nitrite (as N) (353.2)		Total Cyanide (see note) (ISM01.3)		Dissovled Oxygen/Temperature/Conductivity/pH/Turbidity/ORP	
	Week 2	Week 4	Week 2	Week 4	Week 2	Week 4	Week 2	Week 4	Week 2	Week 4	Week 2	Week 4	Week 2	Week 4	Week 2	Week 4
Influent Samples																
- EW-1S	✓														✓	
- EW-1I	✓														✓	
- EW-1D	✓														✓	
- Combined Influent (CI)	✓	✓	✓		✓		✓				✓				✓	✓
Effluent Samples																
- Post air stripper and after caustic injection (EFF)	✓	✓	✓		✓		✓		✓	✓	✓				✓	✓

Notes:

Cyanide and Mercury sample to be collected only in the following week 2 monthly sampling: January, April, July, and October.



Table 3-2
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant
SPDES Permit Equivalent Parameter Analytical Summary
March 2014

Parameter	Influent Samples								Effluent Samples*				Discharge Permit Equivalent Limit	Notes		
	Week 2**						Week 4**		Week 2**		Week 4**					
	EW-11		EW-1S		EW-1D		Combined Influent						Combined Influent			
pH	NS	SU	NS	SU	NS	SU	5.45	SU	5.42	SU	7.42	SU	7.45	SU	6.5 to 8.5 SU	pH values from water quality log in Appendix D
Dichlorodifluoromethane	16	µg/l	1.7	µg/l	11	µg/l	9.2	µg/l	21	K µg/l	0.50	U µg/l	0.50	U µg/l	5.0 µg/l	
1,1-Dichloroethane	0.36	J µg/l	0.12	J µg/l	2.0	µg/l	1.0	µg/l	1.9	µg/l	0.50	U µg/l	0.50	U µg/l	5.0 µg/l	
cis-1,2-Dichloroethylene	6.2	µg/l	3.5	µg/l	4.8	µg/l	4.9	µg/l	5.9	µg/l	0.50	U µg/l	0.50	U µg/l	5.0 µg/l	
trans-1,2-Dichloroethylene	0.26	J µg/l	0.5	U µg/l	1.7	µg/l	0.85	µg/l	0.99	µg/l	0.50	U µg/l	0.50	U µg/l	5.0 µg/l	
trichlorofluoromethane	0.77	µg/l	0.9	µg/l	28	µg/l	12	µg/l	17	µg/l	0.50	U µg/l	0.50	U µg/l	5.0 µg/l	
Methyl tert-Butyl Ether (MTBE)	1.6	µg/l	7.1	µg/l	1.5	µg/l	3.2	µg/l	3.8	µg/l	0.72	µg/l	0.73	µg/l	monitor	
1,1,1-Trichloroethane	0.19	U µg/l	0.50	U µg/l	0.57	µg/l	0.28	J µg/l	0.50	U µg/l	0.50	U µg/l	0.50	U µg/l	5.0 µg/l	
Tetrachloroethylene (PCE)	NS	µg/l	NS	µg/l	NS	µg/l	NS	µg/l	NS	µg/l	0.50	U µg/l	0.50	U µg/l	5.0 µg/l	
Chloroform	0.33	U µg/l	0.2	J µg/l	0.59	µg/l	0.4	J µg/l	0.5	U µg/l	0.50	U µg/l	0.50	U µg/l	NA	
1,1 Dichloroethene	1.3	µg/l	0.5	U µg/l	2.2	µg/l	1.5	µg/l	1.2	µg/l	0.50	U µg/l	0.50	U µg/l	NA	
1,1,2 Trichloro- 1,2,2 Trifluoroethane	0.5	U µg/l	0.5	U µg/l	1.1	µg/l	0.82	µg/l	0.54	µg/l	0.50	U µg/l	0.50	U µg/l	NA	
Trichloroethene	96	µg/l	81	E µg/l	46	E µg/l	67	E µg/l	92	µg/l	0.23	J µg/l	0.50	U µg/l	NA	
Tetrachloroethene	110	µg/l	18	µg/l	49	E µg/l	56	E µg/l	77	µg/l	0.50	U µg/l	0.50	U µg/l	NA	
Trichloroethylene (TCE)	NS	µg/l	NS	µg/l	NS	µg/l	NS	µg/l	89	µg/l	0.50	U µg/l	0.50	U µg/l	5.0 µg/l	
Total Suspended Solids	NS	mg/l	NS	mg/l	NS	mg/l	220	mg/l	NS	mg/l	210.0	mg/l	NS	mg/l	50 mg/l	
Total Dissolved Solids	NS	mg/l	NS	mg/l	NS	mg/l	1.0	U mg/l	NS	mg/l	1	U mg/l	NS	mg/l	1000 mg/l	
Oil & Grease	NS	mg/l	NS	mg/l	NS	mg/l	NS	mg/l	NS	mg/l	5.0	U mg/l	5.0	U mg/l	15.0 mg/l	
Nitrate + Nitrite (as N)	NS	mg/l	NS	mg/l	NS	mg/l	4.3	mg/l	NS	mg/l	4.6	mg/l	NS	mg/l	20 mg/l	
Calcium	NS	µg/l	NS	µg/l	NS	µg/l	15000.0	µg/l	NS	µg/l	15000.0	µg/l	NS	µg/l	NA	
Chromium, Total	NS	µg/l	NS	µg/l	NS	µg/l	5.0	U µg/l	NS	µg/l	5.0	U µg/l	NS	µg/l	100 µg/l	
Copper, Total	NS	µg/l	NS	µg/l	NS	µg/l	10	U µg/l	NS	µg/l	10	U µg/l	NS	µg/l	1000 µg/l	
Cyanide, Total	NS	µg/l	NS	µg/l	NS	µg/l	NS	U µg/l	NS	µg/l	10	U µg/l	NS	µg/l	400 µg/l	
Iron, Total -NET	NS	µg/l	NS	µg/l	NS	µg/l	50	U µg/l	NS	µg/l	50	U µg/l	NS	µg/l	600 µg/l	
Lead, Total	NS	µg/l	NS	µg/l	NS	µg/l	8.0	U µg/l	NS	µg/l	8.0	U µg/l	NS	µg/l	50 µg/l	
Magnesium	NS	µg/l	NS	µg/l	NS	µg/l	6400.0	µg/l	NS	µg/l	6200.0	µg/l	NS	µg/l	NA	
Manganese - NET	NS	µg/l	NS	µg/l	NS	µg/l	17	µg/l	NS	µg/l	16	µg/l	NS	µg/l	monitor	
Mercury, Total	NS	µg/l	NS	µg/l	NS	µg/l	NS	µg/l	NS	µg/l	NS	U µg/l	NS	µg/l	1.4 µg/l	
Potassium	NS	µg/l	NS	µg/l	NS	µg/l	3200.00	µg/l	NS	µg/l	3200.00	µg/l	NS	µg/l	NA	
Silver, Total	NS	µg/l	NS	µg/l	NS	µg/l	5.0	U µg/l	NS	µg/l	5.0	U µg/l	NS	µg/l	100 µg/l	
Sodium	NS	µg/l	NS	µg/l	NS	µg/l	42000.0	µg/l	NS	µg/l	39000.0	µg/l	NS	µg/l	NA	
Zinc, Total	NS	µg/l	NS	µg/l	NS	µg/l	39	µg/l	NS	µg/l	20	µg/l	NS	µg/l	5000 µg/l	

Notes:

Refer to Appendix C for complete analytical data packages.

J - Indicates an estimated value

U - Analyzed for but not detected

L - The reported value may be biased low

K - The reported value may be biased high

NJ - There is presumptive evidence that the analyte is reported as a tentative identification

NS - Not Sampled

NA - Not Applicable

µg/l - micrograms per liter

mg/l - milligrams per liter

SPDES - State Pollutant Discharge Elimination System

SU - Standard Unit

* - Effluent sample is point of compliance with SPDES permit equivalent

** - Week 2 sample collected 3/12/2014, Week 4 sample collected on 3/26/14. Analytes for each sampling event per

SPDES permit equivalent requirements.



Table 3-3
Old Roosevelt Field
Groundwater Treatment Plant
Operating Values

Parameter	Date: 3/5/14	Date: 3/13/14	Date: 3/20/14	Date: 3/26/14
	Reading	Reading	Reading	Reading
Caustic tank T-2 level	275 gallons	275 gallons	275 gallons	275 gallons
Caustic metering pump discharge pressure	NC psi	NC psi	NC psi	NC psi
Pump P-1 discharge pressure	12 psi	2 psi	2 psi	2 psi
Pump P-2 discharge pressure	16 psi	17 psi	17 psi	17 psi
Air stripper blower discharge temp	43 °F	32 °F	41 °F	45 °F
Air stripper blower differential pressure	14 in H ₂ O	14 in H ₂ O	14 in H ₂ O	14 in H ₂ O
VOC level in discharge air	0 ppm	0 ppm	0 ppm	0 ppm
Kilowatt hours (meter reading x40)*	698,640 kWh	708,160 kWh	715,880 kWh	723,600 kWh
Effluent pH	7.41 SU	7.47 SU	7.46 SU	7.45 SU

Legend:

NC - Not Collected

ppm - Parts per million

psi - Pounds per square inch

°F - Degrees Fahrenheit

kWh - Kilowatt hour

in H₂O – Inches water column

SU - Standard Unit

VOC - Volatile Organic Compound

*Spot reading multiplied by factor of 40 per manufacturer's direction

Appendix A
System Run Time Log



Appendix A
Old Roosevelt Field Superfund Site
Groundwater Treatment Plant
System Runtime Log
February 2014

Day	Maximum Bag Filter Differential Pressure psi	Average Effluent pH SU	Well EW-1D daily total discharge gallons	Well EW-1D Aveage Flow Rate gpm	Well EW-1D Average Water Table Elevation ft, amsl	Well EW-1I daily total discharge gallons	Well EW-1I Average Flow Rate gpm	Well EW-1I Average Water Table Elevation ft, amsl	Well EW-1S daily total discharge gallons	Well EW-1S Average Flow Rate gpm	Well EW-1S Average Water Table Elevation ft, amsl	Notes
1	4.26	7.39	138128	96	49.11	69056	48	51.45	69056	48	51.32	
2	7.27	7.40	138176	96	48.74	69088	48	51.09	69088	48	51.08	
3	14.89	7.40	138112	96	48.74	69064	48	51.09	69064	48	51.08	
4	18.08	7.40	138128	96	48.74	69056	48	51.09	69056	48	51.08	
5	20.03	7.40	138176	96	48.74	69088	48	51.09	69088	48	51.08	
6	1.75	7.39	138060	96	49.25	69064	48	51.32	69064	48	51.28	
7	1.88	7.38	138065	96	49.76	69056	48	51.29	69056	48	51.17	
8	1.88	7.39	138067	96	49.13	69088	48	51.10	69088	48	51.09	
9	2.15	7.39	138176	96	49.13	69040	48	51.14	69040	48	51.10	
10	2.93	7.40	138128	96	48.90	69056	48	51.20	69056	48	51.26	
11	4.77	7.40	138112	96	49.06	69088	48	51.35	69088	48	51.35	
12	6.21	7.37	138128	96	50.67	68816	48	52.82	68816	48	52.10	
13	7.39	7.37	137696	96	50.67	69088	48	52.82	69088	48	52.10	
14	0.71	7.37	138128	96	50.67	69064	48	52.82	69064	48	52.10	
15	0.64	7.39	138176	96	50.24	69056	48	52.99	69056	48	52.15	
16	0.85	7.37	138112	96	49.56	69088	48	52.56	69088	48	52.24	
17	0.87	7.39	138176	96	49.43	68092	47	51.98	68092	47	51.90	
18	1.38	7.40	138112	96	48.77	69064	48	51.76	69064	48	51.76	
19	1.57	7.40	138128	96	48.92	69056	48	51.76	69056	48	51.76	
20	2.14	7.40	138160	96	49.63	69040	48	51.91	69040	48	51.75	
21	2.48	7.42	138128	96	49.24	69088	48	51.59	69088	48	51.53	
22	2.76	7.41	138128	96	49.34	69064	48	51.67	69064	48	51.58	
23	2.97	7.42	138144	96	49.23	69072	48	51.57	69072	48	51.50	
24	3.25	7.44	138128	96	50.24	69064	48	52.47	69064	48	52.03	
25	3.53	7.43	138144	96	51.24	69072	48	53.36	69072	48	52.62	
26	6.49	7.44	138176	96	51.37	69088	48	53.49	69088	48	52.73	
27	8.2	7.43	138144	96	50.05	69072	48	52.33	69072	48	52.01	
28	8.93	7.42	138128	96	49.08	69064	48	51.43	69064	48	51.41	
29	2.31	7.41	138192	96	49.18	69096	48	51.53	69096	48	51.47	
30	2.36	7.42	138128	96	49.55	69064	48	51.90	69064	48	51.88	
31	2.4	7.4	138144	96	49.60	69072	48	51.96	69072	48	51.98	

Legend

gpm gallons per minute
SU Standard unit
ft, amsl Feet above mean sea level
max maximum
avg average
NA system/pump was not operating
ND no data available

Appendix F
Document and Records Control Forms



DOCUMENT REVIEW COMMENT RECORD

DOCUMENT

Title: _____
Revision No. _____ Draft ☐ Final ☐ Due Date _____
Project No. _____ Page ____ Of ____
Issuing Group/Organization _____
Author(s) _____

QC REVIEWER

Name _____ Reviewer Signature _____
Group/Organization _____ Review Date _____

TECHNICAL REVIEWER

Name _____ Reviewer Signature _____
Group/Organization _____ Review Date _____

SECTION(S) / AREA(S) TO BE REVIEWED

CLOSURE

Reviewer Signature _____ Author Signature _____
Date _____ Date _____

REVIEW / DISPOSITION (Comments indexed by item No. and Attached)

ITEM NO.	SECTION / PAGE/ PARAGRAPH	AGREEMENT (REVIEWER/AUTHOR)

DOCUMENT REVIEW COMMENT RECORD
(CONTINUED)

DOCUMENT Title: _____	Project No. _____
REVIEWER Name _____	Page ____ of ____

[illegible]

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE				DATE		TRANSMITTAL NO.		
SECTION 1 - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)								
TO: Thomas Mathew CDM 110 Fieldcrest Avenue, 6th Floor Edison, New Jersey 08837		FROM: Arrowhead Contracting, Inc. 10891 Eicher Lenexa, Kansas 66219		SUBCONTRACT NO. 3320-023-001-CN-S			CHECK ONE: __X__ THIS IS A NEW TRANSMITTAL ____ THIS IS A RESUBMITTAL OF TRANSMITTAL NO. _____	
SPECIFICATION SEC. NO.		PROJECT TITLE AND LOCATION Groundwater Remediation Services, Old Roosevelt Field Superfund Site, Garden City, New York						
Item No.	Description of Item Submitted (Type size, model number/ect.)	Manufacturer or Contractor Catalog Curve, Drawing, or Brochure No.	No. of Copies	Contract Reference Document		For Contractor Use Code	Variation Requested	Engineer Review Code
a.	b.	c.	d.	Specification Paragraph No.	Drawing Sheet No.			
				e.	f.	g.	h.	i.
REMARKS:				I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications, except as otherwise stated. ARROWHEAD CONTRACTING , INC _____ NAME AND SIGNATURE OF CONTRACTOR				

Appendix G
Procurement Control Records

CONDITIONS OF PURCHASE ORDER

Title- Title to all materials and/or equipment purchased or supplied pursuant to this purchase order shall, contingent upon payment by vendee, vest in vendee directly upon delivery at the project site, or such location as directed, free and clear of any security interest, claim or lien of any nature.

Indemnity- To the fullest extent permitted by law, vendor shall protect, hold free and harmless, defend and indemnify vendee from all liability, cost, losses, damages, expenses, causes of action, claims or judgments (including attorney fees) resulting from bodily injury, sickness, disease, or death sustained by any person, damage to property of any kind, any alleged or actual infringement or violation of any patent or patent rights, or any breach of contract or warranty, any of which of the foregoing arise out of or is in any way connected with the performance of the obligations and the supplying of goods done under this purchase order to the extent attributable, in whole or in part, to the acts of omissions, or willful or negligent conduct of the vendor and its officers, agents and servants, or to the quality or nature of goods provided hereby. Vendor further agrees, contingent on vendee's payment in satisfaction of this order, to protect and fully indemnify the vendee against all liability for claims and liens for labor, taxes, materials, appliances, equipment and supplies whatsoever, attorney's fees. The foregoing indemnity provisions shall not be construed to negate, abridge or otherwise reduce any other rights of the parties at law or at equity.

Warranty- The supplier warrants that all materials and/or equipment furnished by him to the project shall be new unless otherwise specified, and that all such materials and/or equipment shall be of good quality, free from faults and defects and in conformance with project specifications. All materials and/or equipment not conforming to these standards may be considered defective. Such warranty shall survive delivery and shall survive delivery and shall not be deemed waived wither by reason of vendee's acceptance of materials and/or equipment or by payment for them. Such warranty shall be in addition to and not in limitation of any other warranty or remedy required by law or by the project specifications.

Termination- Should the vendor at any time refuse or neglect to supply a sufficiency of material and/or equipment of the proper quality, or fail in any respect to prosecute the performance of this purchase order with promptness and diligence or fail in the performance of any agreements contained herein, the vendee shall be at liberty after reasonable notice to the vendor to either: provide any such materials, and/or equipment and to deduct the cost thereof from any money then due or thereafter to become due to vendor under this purchase order, or, if the vendee shall deem that such refusal or neglect or failure is sufficient grounds for such actions, to terminate the purchase order.

Delivery- Vendor acknowledges and warrants that payment by vendee, under this agreement, is conditioned upon the timely delivery to the vendee of goods to fully complying with the project specifications in sound, usable, and acceptable condition. Nothing in this agreement shall by construed to create a contractual relationship between vendee and any shipper of goods hereunder. It shall be the

vendor's sole responsibility to arrange for delivery of goods without liability to the vendee. The risk of loss for materials and/or equipment covered by this purchase order, whether in a deliverable state or otherwise, shall remain with the vendor until delivered to the jobsite as herein directed, and actually received by the vendee, and any damage to the material and/or equipment or loss of any kind occasioned in transit shall be borne by the vendor notwithstanding the manner in which the goods are shipped or who pays the freight or other transportation costs. Unless otherwise provided, all materials shipped to the jobsite in performance of this contract shall be shipped prepaid. Failure to so ship and resultant claims by carriers against the vendee for said shipping costs shall result in payment by vendee for said shipping costs shall result in payment by vendee for said charges and set off against the purchase order amount.

Specifications- The vendor hereby agrees to submit or resubmit any and all shop and fabrication drawings, design and performance data, certificates, tests, samples, operating and/or maintenance manuals, schedules, color selections and descriptive product data promptly and as required by any project specifications and/or as directed by the vendee, all in sufficient quantity as to adequately provide for the needs of the vendee. Approval of any of the foregoing by the vendee shall under no circumstances alter the requirements of said specifications for quality, quantity, finish, dimension, design and configuration: nor shall such approval constitute acceptance by the vendee of any method, material or equipment not ultimately acceptable to the owner or the owner's authorized agent of the project of which they become a part; nor shall such approval or the lack thereof relieve the vendor of any of his responsibilities to the vendee pursuant to this agreement. The vendor further agrees that the cost of all designs, drawings, tests, samples, and mockups required pursuant to this agreement, together with field measurements, sampling and shipping or delivery expenses connected with any of the foregoing, shall be included in the amount of this purchase agreement. The vendor hereby agrees that the entire cost of altering, reworking, and refinishing any manufactured or fabricated items or materials provided pursuant to this purchase order and not conforming to approved designs, drawings, or samples shall be borne by the vendor.

Insurance- The vendor, upon request of the vendee, shall submit evidence of vendor's insurance coverage for general, contractual, products and automobile liability.

Lien Waivers- Before issuance of any payment, the vendor, if required, shall submit evidence satisfactory to the vendee that all bills for material and equipment and all known indebtedness connected with this purchase order have been satisfied.

Unit Prices- Unit prices listed for open quantity orders shall remain firm until the date recited on the face hereof.

Seller Initial _____

Buyer Initial _____

Appendix H

Design Control Forms



DESIGN REVIEW RECORD

DOCUMENT

Due Date _____

Project No. _____

Project Title: Old Roosevelt Field Contaminated Groundwater Area Superfund Site

Revision No. _____ ☐ Draft ☐ Final Page ____ Of ____

Issuing Group/Organization _____

Author(s) _____

REVIEWER

Name _____ Reviewer Signature _____

Group/Organization _____ Review Date _____

SECTION(S) / AREA(S) TO BE REVIEWED

CLOSURE

Reviewer Signature _____ Author Signature _____

Date _____ Date _____

REVIEW / DISPOSITION (Comments indexed by item No. and Attached)		
ITEM NO.	SECTION / PAGE/ PARAGRAPH	AGREEMENT (REVIEWER/AUTHOR)

DESIGN REVIEW RECORD (CONTINUED)

DOCUMENT

Title Old Roosevelt Field Contaminated Groundwater Area Superfund Site

Page _____ Of _____

REVIEWER

Name _____

[illegible]

Appendix I
Measurement and Test Equipment Forms



By _____

Page _____ of _____

[illegible]

Appendix J
Inspection Forms



Arrowhead Contracting, Inc.

Sheet ____ of ____

Preparatory Inspection Checklist				
Definable Feature of Work (DFW):	Date:			Subcontract No:
	Time:			
Item	Yes	No	NA	Remarks
Have pertinent subcontract requirements and work plans been explained to project personnel (e.g. technical specifications)?				
Have required control inspections, sampling, and field measurement / test requirements been explained to project personnel?				
Have project documentation and recordkeeping requirements been explained to project personnel (e.g. project forms, logs, photographs, records)?				
Have all necessary subcontracts and purchase orders been established?				
Have all applicable permits, licenses, and certifications been identified or obtained?				
Have project planning documents been reviewed and approved by CDM?				
Are required materials, supplies, and equipment on-hand, available, in working order, and are in accordance with plans and technical specifications?				
Has all front-end and site layout work been completed in preparation for commencing the DFW?				
Have the requirements of the EPP been explained to project personnel?				
Have the requirements of the SSHP been explained to project personnel?				
Have the requirements of the SAMP/QAPP been explained to project personnel?				
Notes:				



Arrowhead Contracting, Inc.

Sheet of

Initial/Follow-up Inspection Checklist				
Definable Feature of Work (DFW):	Date:		Subcontract No:	
	Time:			
Inspection Type (circle one): Initial Follow-up				
Item	Yes	No	NA	Remarks
Is the work being performed in accordance with the applicable section(s) of the subcontract specifications?				
Is the work being performed in accordance with approved design drawings and specifications?				
Is the work being performed in accordance with approved work plans (e.g. CQCP, EPP, SAMP/QAPP)?				
Is the work being performed cautiously and with acceptable levels of workmanship?				
Is equipment being operated properly?				
Is the work being performed using proper methods and procedures?				
Have any defective or damaged materials been identified?				
Are results of applicable tests, samples, and/or measurements within acceptable levels?				
Is the work being performed in a safe manner and in accordance with the SSHP?				
Have pertinent records been completed or collected?				
Have any nonconformances been identified, corrected, and re-inspected?				
Notes:				

Appendix K
Nonconformance and Corrective Action Forms



Nonconformance Report

Old Roosevelt Field	Subcontract No.	NCR No.:
Site Location: Garden City, NY	Date:	WAD:
Description of Nonconformance:		
Prepared by: _____ Quality Control Representative		Date:
Reviewed by: _____ Contractor Quality Control Manager		Date:
Disposition:		
Recommended by: _____		Date:
Reviewed by: _____ Quality Control Representative		Date:
Corrective Action Verification:		
Implemented by: _____		Date:
Verified by: _____ Quality Control Representative		Date:
Nonconformance Closeout:		
_____		Date:
Contractor Quality Control Manager		



CORRECTIVE ACTION REQUEST

ADVERSE TREND: Yes <input type="checkbox"/> No <input type="checkbox"/>		CAR Number:		Date:
Organization/Project/Department:			Person contacted:	
Discrepancy (includes Specific Requirements Violated): 				
Originator:		Response Due Date:		
Corrective Action Taken/Proposed to Correct Discrepancy: 				
Corrective Action Taken to Prevent Reoccurrence (the cause of the discrepancy must also be included here): 				
Corrective Action Taken by (signature and title):		Date When Corrective Action will be Completed:		
Corrective Action Evaluated 		Verification of Implementation: 		
Evaluated By:	Date:	Verified By:	Date:	



STOP WORK ORDER

Subcontract No. _____

Project No. _____

Task Order No. _____

SWO NO.: _____ STOP WORK ORDER _____ PAGE ____ OF ____

1. Written Notice Issued To:

2. P.O. # or Activity:

4. Issued By:

Name : _____

Name: _____

Title : _____

3. Location:

Org. : _____

Title: _____

5. Verbal Notice Issued To:

Name: _____ Title: _____ Date: _____ Time: _____ am

pm

6. Associated NCR's YES ___ NO ___

Report No. _____

7. Associated C.A.R. :

Yes ___ No ___ Request No. _____

8. Description of Stop Work Order Condition:

attachment ____

9. Remedial Action Required:

attachment ____

By Whom: _____ By When: _____

Required Remedial Action Determined By:

Project Manager: _____

Date: _____

Quality Control Manager: _____

Date: _____

Engineering Manager: _____

Date: _____

10. Follow-Up of Remedial Action Taken:

attachment ____

Verbal Notice To Resume Operations Given To:

Name: _____ Title: _____ Date: _____ Time: _____ am

pm

Stop Work Order Cancellation Authorized By:

Quality Control Manager: _____ Date: _____

Appendix L
Change Control Forms



Field Work Variance	
Variance Number:	Project Number:
Date:	
Present Requirements:	
Proposed Change:	
Technical Justification:	
Cost/Schedule Impact:	
Reason for Change:	
Addition _____ Deletion _____	
Change Order Required: Yes _____ No _____ Change Order Number:	
Requested By:	Date:
Applicable Document:	
None	
CC: Distribution	
Approved By: _____ Arrowhead Project Manager	_____
Approved By: _____ Arrowhead Quality Control Manager	_____
Approved By: _____ CDM Site Lead	_____
Approved By: _____ CDM Project Manager	_____
Approved By: _____ CDM Contracting Officer's Representative	_____

Appendix M
Subcontractor Control Forms



SUBCONTRACTOR DAILY TRACKING LOG

Contractor: _____

Description of Work Performed/Location: _____

Manpower:

Name	Trade	Hours

Equipment: _____

Materials: _____

Subcontractor Representative: _____ Date: _____

Printed Name/Title: _____

Arrowhead Management Approval: _____ Date: _____

Printed Name/Title: _____

Appendix N
Material Receipt Inspection Forms



RECEIPT INSPECTION

Contractor: Arrowhead Contracting, Inc.
Subcontract No. _____
Project Name/No. _____
Vendor Name _____
Item Name or Description _____

Report No. _____
Task Order _____
P.O. No. _____

Y - YES; N - NO (SEE REMARKS); NA - NOT APPLICABLE	
Item conforms to the Buy American Act Requirements	
Procurement documents were reviewed and used for inspection	
Required supporting documentation has been received (i.e., MSDS, certifications)	
Item numbers/volume corresponds to those identified on procurement documents	
Item is visually free of defects or damage	
Item meets task order specification	
Is item acceptable for release	

REMARKS:

Receipt Inspector

Date

Site QCM

Date

Appendix O
Project Submittal Register

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		01201--1.5.1	Conference Meeting Minutes			x										x	
		01202--1.3.1	Project Progress Meeting Minutes			x										x	
		01310--1.2.1	Project Organizational Chart	x												x	
		01310--1.2.2	Project Manager Name and Experience	x												x	
		01320--1.3.1	Initial Project Schedule	x												x	
		01320--1.3.2	Revised Project Schedule	x												x	
		01351--1.3.1	Site Safety and Health Plan	x												x	
		01351--1.3.2	Weekly Safety and Accident Reports			x									x		
		01351--1.3.3	Air Monitoring Data			x									x		
		01351--1.3.4	Personnel Health and Safety Certificates							x					x		
		01351--1.3.5	Safety and Health Manager Statements							x					x		
		01351--1.3.6	Certificate of Worker/Visitor Acknowledgement							x					x		
		01351--1.3.7	Project Safety and Health Phase-Out Report											x	x		
		01355--1.3.1	Environmental Protection Plan	x												x	
		01380--1.2.1	Project Photographs			x									x		
		01450--1.3.1	Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP)	x												x	

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		01450--1.3.2	ANSETS Data Requirement Form and Trip Report						x						x		
		01450--1.3.3	Topsoil Material Testing Results						x							x	
		01450--1.3.4	Analytical Data						x							x	
		01450--1.3.5	Non-Conformance Reports						x						x		
		01450--1.3.6	Chemical Data Final Report (CDFR)						x							x	
		01451--1.3.1	CQC Plan	x												x	
		01451--1.3.2	CQC Organizational Changes			x										x	
		01451--1.3.3	CQC Reports			x									x		
		01500--1.2.1	Temporary Site Facility Layout Plan		x											x	
		01550--1.2.1	Surveyor Qualifications			x									x		
		01550--1.2.2	Surveyor Accuracy Documentation			x									x		
		01550--1.2.3	Surveyor Field Notes			x									x		
		01550--1.2.4	As-Built Drawings											x		x	
		01780--1.3.1	Interim Remedial Action (RA) Report											x		x	
		01800--1.2.1	Notification of Maintenance Activities										x		x		
		01800--1.2.2	Monthly Operating Logs										x		x		
		01800--1.2.3	Initial Testing Program (ITP) Report						x						x		
		01800--1.2.4	Quarterly Remedial Progress Reports						x						x		

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		01800--1.2.5	Computerized Recordkeeping System										X			X	
		01800--1.2.6	Optimization Report						X						X		
		01850--1.3.1	System O&M Manual										X			X	
		01850--1.3.2	User Startup Training and Instruction Schedule	X												X	
		01850--1.3.3	Proposed Changes to the O&M Manual										X			X	
		01851--1.2.1	Chemical Additives and Agents			X										X	
		01851--1.2.2	Extraction Well Testing Results						X						X		
		02100--1.3.1	Site Preparation Plan	X												X	
		02100--1.3.2	Crushed Stone Aggregate Certificates of Compliance							X					X		
		02100--1.3.3	Geotextile Filter Fabric Certificates of Compliance							X					X		
		02100--1.3.4	Permits							X					X		
		02120--1.3.1	Transportation Plan	X												X	
		02120--1.3.2	Notice of Non-Compliance and Notice of Violation			X									X		
		02120--1.3.3	Transport Certification							X					X		
		02120--1.3.4	Annual and Biennial Reports						X							X	
		02120--1.3.5	Shipping Documents and Packaging Certification							X						X	

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		02120--1.3.6	EPA Off-Site Policy							x					x		
		02120--1.3.7	Certificates of Disposal							x					x		
		02120--1.3.8	Disposal Facility Names and Permits	x												x	
		02300--1.3.1	Excavation, Trenching, and Backfill Plan	x												x	
		02300--1.3.2	Laboratory and Field Test Results						x						x		
		02300--1.3.3	Earthen Materials Certificates of Compliance							x					x		
		02370--1.3.1	Soil Erosion and Sediment Control Plan	x												x	
		02370--1.3.2	Samples				x									x	
		02370--1.3.3	Permits							x					x		
		02510--1.3.1	Valves		x											x	
		02510--1.3.2	Material List			x										x	
		02510--1.3.3	Satisfactory Installation			x										x	
		02510--1.3.4	Certificates of Compliance							x					x		
		02510--1.3.5	Hydrostatic Testing and Disinfection						x							x	
		02510--1.3.6	Installation Instructions								x				x		
		02576--1.3.1	Certified Mix Designs	x												x	
		02576--1.3.2	Certified Test Results for Gravel Gradation					x							x		
		02821--1.3.1	Fencing		x											x	
		02821--1.3.2	Material Certificates							x					x		

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		02900--1.3.1	Material Certificates							x						x	
		03100--1.3.1	Detail Drawings		x											x	

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		03100--1.3.2	Form Design			X										X	
		03100--1.3.3	Form Materials			X										X	
		03100--1.3.4	Form Releasing Agents				X									X	
		03100--1.3.5	Form Releasing Agents								X				X		
		03100--1.3.6	Certificates							X					X		
		03150--1.3.1	Product Data			X										X	
		03150--1.3.2	Certifications							X					X		
		03200--1.3.1	Reinforcing Steel Shop Drawings		X											X	
		03200--1.3.2	Mill Test Reports						X							X	
		03200--1.3.3	Welder's Certification							X					X		
		03300--1.3.1	Mixture Proportions			X										X	
		03300--1.3.2	Testing and Inspection for Contractor Quality Control						X						X		
		03300--1.3.3	Qualifications, Manufacturer's Certification							X					X		
		03410--1.3.1	Shop Drawings		X											X	
		03410--1.3.2	Design Data						X							X	
		03410--1.3.3	Test Reports						X							X	
		03410--1.3.4	Material Certificates							X					X		

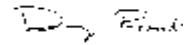
TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		03410--1.3.5	Compliance Certificates							x					x		
		11319--1.3.1	Pump Selection Calculations and Performance Data		x											x	
		11319--1.3.2	Manufacturer's Installation Instructions								x				x		
		11319--1.3.3	Manufacturer's Descriptive Data			x									x		
		11319--1.3.4	Technical Literature			x									x		
		11319--1.3.5	Manufacturer's Certified Pump Curve			x									x		
		11319--1.3.6	Corrosion Protection Certificate							x					x		
		11319--1.3.7	O&M Manual					x							x		
		13122--1.2.1	Building Layout Drawings	x												x	
		13122--1.2.2	Structural Drawings and Specifications	x												x	
		13122--1.2.3	HVAC, Plumbing, and Fire Protection Drawings and Specifications	x												x	
		13122--1.2.4	Shop Drawings		x											x	
		13122--1.2.5	Color Samples				x									x	
		13122--1.2.6	P.E. Certification							x					x		
		13122--1.2.7	Erection Drawings		x											x	
		13122--1.2.8	Manufacturer's Certifications							x					x		

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		13122--1.2.9	Warranty							x					x		
		13122--1.2.10	Sanitary Waste Holding Tank Permit							x					x		
		13300--1.2.1	Pilot Testing Plan	x												x	
		13300--1.2.2	Groundwater Treatment Plan	x												x	
		13300--1.2.2.1	Groundwater Treatment Equipment			x										x	
		13300--1.2.2.2	Process Flow and Instrumentation Diagrams		x											x	
		13300--1.2.2.3	Plan and Cross-Sectional View of Treatment System Layout		x											x	
		13300--1.2.5	Equipment Certificates							x					x		
		13300--1.2.6	Calculations					x								x	
		13300--1.2.7	Test Reports						x							x	
		13300--1.2.8	Warranty							x					x		
		13300--1.2.9	Hardware and Software Design					x								x	
		15200--1.3.1	Shop Drawings		x											x	
		15200--1.3.2	Product Data			x										x	
		15200--1.3.3	Statements of Satisfactory Installation and Thrust Restraint Methods						x						x		
		15200--1.3.4	Equipment Samples as Appropriate				x								x		

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		15200--1.3.5	Design Data and Assumptions					x								x	
		15200--1.3.6	Certified Shop Tests							x					x		
		15200--1.3.7	Performance Testing						x						x		
		15200--1.3.8	Certification							x					x		
		15200--1.3.9	Manufacturer's Certification							x					x		
		15200--1.3.10	Equipment/System Warranty							x					x		
		16000--1.3.1	Shop Drawings		x											x	
		16000--1.3.2	Manufacturer's Product Information			x										x	
		16000--1.3.3	Electrical Installation Drawings		x											x	
		16000--1.3.4	Test Reports						x						x		
		16110--1.2.1	Product Data			x									x		
		16110--1.2.2	Samples				x								x		
		16191--1.2.1	Catalog Information			x										x	
		16220--1.3.1	Motor Data			x										x	
		16220--1.3.2	Dimension Drawings		x											x	
		16220--1.3.3	Equipment Guarantee							x					x		
		16220--1.3.4	Equipment Warranty							x					x		

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	SPECS PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL											CLASSIFICATION		R E V I E W E R
				P R E C O N S T S U B M I T T A L	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		16261--1.3.1	Shop Drawings		x											x	
		16261--1.3.2	Equipment Data			x										x	
		16261--1.3.3	Test Reports						x						x		
		16261--1.3.4	Manufacturer's Instructions								x				x		
		16261--1.3.5	Manufacturer's Field Reports									x			x		
		16261--1.3.6	Equipment Warranty							x					x		
		16375--1.4.1	Manufacturer's Catalog Data			x										x	
		16375--1.4.2	Material, Equipment, and Fixtures List			x										x	
		16375--1.4.3	Electrical Distribution System Drawings		x											x	
		16375--1.4.4	Factory Test						x						x		
		16375--1.4.5	Field Testing Plan						x							x	
		16375--1.4.6	Test Reports						x							x	
		16375--1.4.7	Materials and Equipment Certificates							x						x	
		16402--1.3.1	Manufacturer's Catalog			x										x	
		16402--1.3.2	Material, Equipment, and Fixtures Lists			x										x	
		16402--1.3.3	Installation Procedures			x										x	
		16402--1.3.4	Interior Electrical Equipment Drawings		x											x	
		16402--1.3.5	Structural Drawings		x											x	
		16402--1.3.6	Electrical Drawings		x											x	

TITLE AND LOCATION: OLD ROOSEVELT FIELD SUPERFUND SITE, GARDEN CITY, NASSAU COUNTY, NY															CONTRACTOR		
N A S S A U C O U N T Y C O D E	I T E M N U M B E R	S P E C S P A R A G R A P H N U M B E R	D E S C R I P T I O N O F I T E M S U B M I T T A L	T Y P E O F S U B M I T T A L											C L A S S I F I C A T I O N		R E V I E W E R
				P R E C O N S T	S H O P D R A W I N G S	P R O D U C T D A T A	S A M P L E S	D E S I G N D A T A	T E S T R E P O R T S	C E R T I F I C A T E S	M F R S I N S T R U C T I O N S	M F R S F I E L D R E P O R T S	O & M D A T A	C L O S E O U T S U B M I T T A L	I N F O R M A T I O N O N L Y	E N G I N E E R A P P R O V E D	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
		16402--1.3.7	Onsite Test						x							x	
		16402--1.3.8	Factory Test Reports						x							x	
		16402--1.3.9	Field Test Plan						x							x	
		16402--1.3.10	Field Test Reports						x							x	
		16402--1.3.11	Materials and Equipment Certificates							x						x	
		16502--1.3.1	Lighting Protection System		x											x	
		16502--1.3.2	Lighting Protection System					x								x	
		16600--1.4.1	Shop Drawings		x											x	
		16600--1.4.2	Product Data			x										x	
		16660--1.3.1	Shop Drawings		x											x	
		16660--1.3.2	Product Data			x										x	
		16660--1.3.3	Test Results						x							x	
		16742--1.4.1	Shop Drawings		x											x	
		16742--1.4.2	Spare Parts			x										x	
		16742--1.4.3	Manufacturer's Recommendations								x					x	
		16742--1.4.4	Test Plan						x							x	
		16742--1.4.5	Qualifications	x												x	
		16742--1.4.6	Test Reports						x						x		
		16742--1.4.7	Materials and Equipment							x					x		
		16742--1.4.8	Operation and Maintenance Data										x		x		

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE				DATE 09/18/14		TRANSMITTAL NO. 1355-1.1		
SECTION 1 - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)								
TO: Thomas Mathew CDM Smith 110 Fieldcrest Avenue, 6th Floor Edison, New Jersey 08837			FROM: Arrowhead Contracting, Inc. 10891 Eicher Lenexa, Kansas 66219		SUBCONTRACT NO. 3320-048-001-CN		CHECK ONE: ____ THIS IS A NEW TRANSMITTAL __X__ THIS IS A RESUBMITTAL OF TRANSMITTAL NO. _1355-1_____	
SPECIFICATION SEC. NO. 1355			PROJECT TITLE AND LOCATION Groundwater Remediation Services - Southern Plume Expansion, Old Roosevelt Field Superfund Site, Garden City, New York					
Item No.	Description of Item Submitted (Type size, model number/ect.)	Manufacturer or Contractor Catalog Curve, Drawing, or Brochure No.	No. of Copies	Contract Reference Document		For Contractor Use Code	Variation Requested	Engineer Review Code
				Specification Paragraph No.	Drawing Sheet No.			
a.	b.	c.	d.	e.	f.	g.	h.	i.
	Response to Comments on transmittal 1355-1	Arrowhead	1					
1	Environmental Protection Plan, rev 1	Arrowhead	1	1.3.1				
REMARKS:				I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications, except as otherwise stated. ARROWHEAD CONTRACTING , INC Doug Ronk  NAME AND SIGNATURE OF CONTRACTOR				



September 17, 2014

Mr. Thomas Mathew, P.E.
Project Manager
CDM Federal Programs
110 Fieldcrest Avenue
Edison, New Jersey 08837

**Subject: Contract Submittal Review – 1355-1
Old Roosevelt Field Contaminated Groundwater Area Superfund Site, Southern
Plume Plant Expansion**

Dear Mr. Mathew:

This letter presents the responses by Arrowhead Contracting to your comments on the subject submittal. Comments have been incorporated in the shop drawings as appropriate or a response has been generated as indicated in this letter.

If you have any questions or comments please contact me at (913) 814-9994.

Sincerely,

A handwritten signature in black ink that reads "Doug Ronk". The signature is written in a cursive, slightly stylized font.

Doug Ronk
Project Manager

CDM Comment:

1. General - Per specification section 01355 Paragraph 1.3.1.3, please include the name and qualifications for the person responsible for training the environmental protection personnel.

Arrowhead Response:

Section 1.6 has been added to discuss environmental protection training. The resume for the Site Supervisor, Joe Cotter, has been attached. Mr. Cotter will be responsible for training all new personnel at the site on the environmental protection procedures.

2. General - Per specification section 01355 Paragraph 1.3.1.4, please describe the environmental protection personnel training program.

Arrowhead Response:

Section 1.6 has been added to discuss environmental protection training.

3. General – Please update all references of “CDM” to “CDM Smith”

Arrowhead Response:

The plan has been revised.

4. Table of Contents - Please update the page numbers that are not defined.

Arrowhead Response:

The text has been revised.

5. Section 2.2 - Please clarify if real-time dust monitoring will be performed. Dust monitoring and action levels were included in the HASP.

Arrowhead Response:

Real-time dust monitoring will include visual inspection (zero visible dust as the goal). If the SSHO determines additional monitoring is required, particulate monitoring will be completed with action levels as specified in the HASP.

6. Section 5.0 – Please revise the 7th bullet, since water will not be collected from the excavations.

Arrowhead Response:

The bullet point has been deleted.

7. Section 5.0 – Please include how demolished concrete and pavement will be addressed.

Arrowhead Response:

The text in the “recyclable waste” section has been revised.

8. Section 5.0 – Please include how water generated from flushing and hydrostatic testing of the lines will be addressed.

Arrowhead Response:

Potable water from hydrostatic testing will be discharged through the treatment system during initial startup testing. This water will also serve to flush the influent

piping of any debris. Water will be processed through bag filtration and air stripping before discharge to the effluent outfall. The text has not been revised.

9. Section 6.3 - Please reference the NYSDEC Spill Guidance Manual.

Arrowhead Response:

A reference to the website containing the NYSDEC Spill Guidance Manual has been included.

10. Section 6.3 - Please clarify the source of the 25 gallon reporting criteria. Per Section 1.1 of the NYSDEC Spill Guidance Manual, petroleum spills must be reported to NYSDEC unless they meet all of the following criteria:

- The spill is known to be less than 5 gallons; and
- The spill is contained and under the control of the spiller; and
- The spill has not and will not reach the State's water or any land; and
- The spill is cleaned up within 2 hours of discovery.

Arrowhead Response:

The text has been revised.

11. Section 6.3 - Please confirm the NYS phone number for spill reporting. The phone number for the NYS Spill Hotline is 800-457-7362.

Arrowhead Response:

The spill response hotline number has been revised.

**ENVIRONMENTAL PROTECTION PLAN
REMEDIAL CONSTRUCTION ACTIVITIES
OLD ROOSEVELT FIELD CONTAMINATED GROUNDWATER AREA SUPERFUND SITE
GARDEN CITY, NEW YORK**

SUBCONTRACT NO. 3320-048-001-CN

Submitted to:

**CDM Federal Programs Corporation
110 Fieldcrest Ave., 6th Floor
Edison, New York 08837**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher
Lenexa, Kansas 66219**

Revision 1

September 2014

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List of Acronyms

Arrowhead	Arrowhead Contracting, Inc.
CFR	Code of Federal Regulation
CDM Smith	CDM Federal Programs Corp.
CVOC	chlorinated volatile organic compound
CY	Cubic Yard
DCE	Dichloroethene
DOT	Department of Transportation
EPP	Environmental Protection Plan
GAC	granular activated carbon
MSDS	Material Safety Data Sheet
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
O&M	operations and maintenance
PCE	tetrachloroethene
PEL	Permissible Exposure Limit
PID	photoionization detector
PPE	personal protective equipment
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SSHP	Site Safety and Health Plan
SSHO	Site Safety and Health Officer
TCE	trichlorethene
TCLP	Toxicity Characteristic Leaching Procedure
VOC	volatile organic compound

1.0 Introduction

This document constitutes the Environmental Protection Plan (EPP) for field activities associated with the Remedial Construction at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site (Site), Garden City, New York. This document was prepared for CDM Federal Programs Corporation (CDM Smith) under Subcontract No. 3320-048-001-CN. This EPP covers field activities conducted by Arrowhead Contracting, Inc. (Arrowhead) and its subcontractors in accordance with the subcontract scope of work. The purpose of the EPP is to present the control measures that will be implemented to ensure that field activities conducted by Arrowhead do not adversely impact the soil, water, and air. This document has been prepared in accordance with the following subcontract specifications:

- Section 01355 (Environmental Protection)
- Section 02370 (Soil Erosion Control), including the requirements for an Environmental Protection and Spill Control Plan and Soil Erosion and Sediment Control Plan, which has been submitted to the Nassau County Soil Water Conservation District
- Section 02120 (Offsite Transportation and Disposal), including the requirements for a Waste Management Plan

1.1 Site Description

The site is located in the Village of Garden City, Nassau County, New York. The Site is located on the eastern side of Clinton Road, approximately 0.6 mile south of the intersection with Old Country Road. The Site includes a thin strip of open space along Clinton Road (known as Hazalhurst Park), a large retail shopping mall with a number of restaurants, and a movie theater. Several office buildings (including Garden City Plaza) share parking space with the shopping mall.

Two municipal water supply well fields are located south (downgradient) of the Site. The Village of Garden City public water supply wells (designated as GWP-10 and GWP-11) are located just south of the Site boundary, on the eastern side of Clinton Road. The Hempstead well field is located approximately 1.5 miles south of the Garden City supply wells. Two stormwater recharge basins are directly east and south of the mall area. The eastern basin, Pembroke, is located on the property owned by the mall. The basin to the south is Nassau County Recharge Basin number 124.

Groundwater at the Site is contaminated with volatile organic compounds (VOCs), particularly chlorinated VOCs such as tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and 1,1-dichloroethene (1,1-DCE). The highest levels of PCE and TCE detected in groundwater are 300 and 960 ug/l, respectively. The remedy, as defined in the September 2007 Record of Decision (ROD), involves groundwater extraction and ex-situ treatment (pump and treat) in order to expedite the restoration of water quality in the aquifer in comparison with natural processes alone, and provide for vapor intrusion mitigation, if deemed necessary.

1.2 Field Activities

The goal of this project is to perform remedial construction activities associated with expansion construction of the groundwater treatment plant. The project will also involve Operations and Maintenance (O&M) of the groundwater treatment plant once construction is completed. Arrowhead's scope of work includes the following activities:

- Mobilization
- Preparation of design documents
- Site preparation, including set-up of work zones and support areas, and laydown area (i.e. for equipment/vehicle/materials storage), and utility location
- Site utility installation
- Installation of yard piping and well head construction
- Upgrade of existing process equipment
- Site cleanup/demobilization from construction phase
- O&M

1.3 Environmental Impacts

Potential impacts to the environment from construction activities may occur as a result of the following:

- Erosion and runoff from areas where soil is excavated or the ground surface is otherwise disturbed
- Generation, storage, and disposal of solid wastes, including municipal trash, clearing and grubbing debris, and surplus soil
- Dust emissions from construction activities
- Noise from construction and treatment system operations
- Potential spills from refueling small equipment

- Potential release of contaminated groundwater from the influent transmission lines

The remainder of this EPP addresses each of these potential sources of environmental impact.

A Phase 1B Cultural Resources Survey was completed of the construction area of the Site by Richard Grubb & Associates, Inc (October 2010) and no significant historic or prehistoric cultural resources were identified. Since impacts to historical, archeological, and cultural resources are not anticipated, these topics are not addressed in this plan.

Please note that site soils are considered to be not contaminated with respect to VOCs because they are located above the water table and are not in direct contact with contaminated groundwater. Investigation activities at the site have not identified any VOC impacted shallow soils within the work area.

1.4 Applicable Requirements

Activities completed at the Site will meet all substantive requirements for environmental protection. The following is a general description of applicable requirements.

- **Wastewater** – Waste water will not be pumped from excavations but instead will be allowed to soak into the soil below the excavation. The subsoil in the area is clean sand and based on previous experience at this site that the soil will easily allow water to infiltrate. A review of the United States Department of Agriculture Soil Conservation Service maps for the area indicates that the soil is very permeable sand and gravel outwash. The soil at a depth of 33 to 60 inches bgs has a permeability of more than 20 inches per hour.

Wastewater generated as the result of the equipment decontamination process will be containerized and sampled to determine the appropriate means of disposal.

- **Air** – Off-gas from the air stripper will be discharged directly to atmosphere without treatment. Air samples will be collected and analyzed using EPA Method TO-15 to verify compliance with air discharge criteria. Refer to the Quality Assurance Project Plan (QAPP) for additional discussion related to analytical testing requirements.

Although not anticipated, VOC emissions that may be generated as a result of general excavation activities will be monitored to ensure the protection of field personnel and the public. Control measures will be implemented as necessary to ensure compliance with OSHA permissible exposure limits (PELs). Site personnel will visually monitor ambient

dust levels during construction. When visible dust emissions become noticeably elevated, dust suppression methods will be implemented immediately. Refer to Section 2.0 for additional detail.

- **Solid Waste** – As previously discussed, it is anticipated that soil generated during all excavations will not be contaminated. This soil will be used as non-structural backfill material in the influent groundwater pipe trench. Soil will be placed and compacted in accordance with Specification Section 02300.

Excess soil that is not needed as backfill material will be disposed off-site. The soil will be sampled and analyzed in accordance with QAPP Worksheet #17a to characterize and profile the waste for subsequent disposal. The sampling requirements (number of samples and analytical methods required) will be provided by the recycling or disposal facility based upon their permit requirements. As required, the permitting, waste profiling manifests, and packaging requirements of receiving disposal facilities will be followed.

All non-hazardous solid wastes, such as municipal trash and clean construction debris, will be transported to a local transfer station for disposal at a licensed facility. This waste will be disposed without any sampling requirements.

- **Erosion** –Erosion control measures will be implemented during construction in accordance with Clean Water Act best management practices and Section 02370 of the subcontract specifications and the project Soil Erosion and Sediment Control Plan. Refer to Section 3.0 for additional detail.
- **Noise** – Local noise ordinances will be observed. All construction equipment will be fitted with mufflers and machine operation will be kept to a minimum.

1.5 Responsibilities

The Project Manager has the ultimate responsibility for environmental compliance and protection. The Project Manager's responsibilities include ensuring that all activities are planned in accordance with applicable requirements (refer to Section 1.4) and that the necessary oversight, personnel, equipment, subcontractors, and services are made available. The Site Supervisor and Site Health and Safety Officer (SSHO) will assist the Project Manager by enforcing the requirements of site-specific plans and procedures, including this EPP. The Site Supervisor will also have responsibility for day-to-day environmental protection activities, such as dust control, erosion and sediment control, spill cleanup (as necessary), and waste management.

1.6 Environmental Protection Training

The Site Supervisor, Joe Cotter, will be responsible for delivering the content of the EPP during site orientation and daily tailgate safety meetings. The EPP training shall include at a minimum the following topics:

- The contract scope of work and associated plans, including the EPP and Health and Safety Plan
- Safe handling procedures and storage requirements for chemical products utilized at the site, including the location Safety Data Sheets are located.
- Anticipated solid waste streams and procedures for handling and disposal. Requirements for recycling general constructions waste (ie. cardboard, wood, metal) will be reviewed.
- Spill reporting protocols, including a listing of emergency response contacts
- Spill response and cleanup procedures
- Storm water pollution prevention techniques, including erosion control measures and best management practices
- Dust control measures
- Reporting procedures if personnel encounter unanticipated contaminated material.

2.0 Air Pollution and Dust Control

This section discusses the procedures for ensuring the protection of air quality during the project.

2.1 VOCs

Real-time, ambient VOC levels will be monitored during the construction phase of the project using a photoionization detector (PID) equipped with an 11.7 eV ionization lamp. Monitoring will be conducted within the breathing zone of personnel during the field activities involving excavation. If breathing zone VOC levels exceed the actions level as specified in the Site Safety and Health Plan (SSHP), the level of PPE will be upgraded to include respiratory protection. Based on the results of real-time breathing zone monitoring, additional VOC monitoring may be conducted at the site perimeter or at off-site locations to evaluate public exposure potential. The SSHP presents further details associated with real-time VOC monitoring.

Off-gas from the air stripper will be discharged directly to atmosphere without treatment. Modeling has shown that VOC concentrations are below NYSDEC regulatory levels and do not require treatment. Air samples will be collected and analyzed using EPA Method TO-15, in accordance with the Quality Assurance Project Plan (QAPP).

2.2 Dust

Releases of dust may occur from trenching, pavement demolition, building construction, site work, truck loading/unloading, and off-hour wind entrainment. The generation of dust and fugitive emissions shall be prevented whenever possible and controlled when necessary. Work practices shall be adjusted in a manner to minimize dust generation. To control dust emissions, both operational and administrative controls will be implemented. The adequacy of dust control will be monitored by visual inspection.

Operational Controls

The operational controls that may be implemented include:

- Minimizing material free-fall from excavation equipment (e.g., loaders and excavators) and removing all soil from exterior surfaces of haul trucks
- Following proper decontamination protocols for equipment entering and leaving the site (refer to SSHP)

- Staging trucks for loading on pavement rather than soil, to the extent possible
- Covering and securing loads on haul trucks using tarps
- Water spraying exposed soil during excavation, taking care to avoid overspraying
- Water spraying loads when transporting materials, taking care to avoid overspraying
- Water spraying piles of soil, sand, and gravel
- Covering piles of soil, sand, and gravel with plastic sheeting
- Using paved streets and roads when available
- Water spraying haul routes

Administrative Controls.

Administrative controls that may be implemented include the following:

- Maintaining speed limits on roads
- Visually monitoring ambient dust levels (refer to SSHP)
- Stopping or restricting work activities when dust levels become elevated or when the wind speed is excessive

3.0 Erosion and Sediment Control

Erosion and sediment control measures will be implemented to minimize the transport of sediment off-site and into storm water outfalls. The Site Supervisor will select the appropriate methods for erosion and sediment control consistent with actual conditions observed in the field, including topography, drainage features, locations of storm drains, storm water runoff patterns, and sediment content of storm water run off. All soil erosion and sediment control shall be performed in accordance with Section 02370. Refer to the Soil Erosion and Sediment Control plan for a discussion of means and methods for erosion control.

4.0 Noise Control

Sources of noise at the project site include the operation of heavy construction equipment, drilling operations, and treatment system operations (inside the building). In lieu of real-time noise monitoring, hearing protection will be required during the aforementioned activities and during other activities/operations, based on the discretion of the SSHO. Arrowhead will perform noise dosimetry if it is deemed necessary by the Arrowhead Designated Safety Coordinator, the CDM SMTIH Site Supervisor, or if there are noise complaints from third parties. Since Arrowhead does not anticipate using any excessively loud equipment, it is unlikely that noise dosimetry will be required.

5.0 Waste Management and Disposal

Wastes generated during the project will be handled and disposed in accordance with Section 02120 of the contract specifications. Anticipated waste streams include:

- Non-hazardous, municipal solid wastes from clean construction work and site administration activities
- Non-reusable sampling equipment and PPE
- Recyclable materials (metal, wood, paper, plastic)
- Incidental materials (used oil and oily rags) from equipment maintenance activities
- Clearing and grubbing debris
- Surplus soil from pipe trenches, and site preparation
- Wastewater from the decontamination of excavation equipment and sampling equipment and other equipment that makes contact with potentially contaminated groundwater

The following subsections discuss the management and disposal of these waste streams to ensure compliance with local and federal regulations.

5.1 On-site Waste Management

The following paragraphs discuss the on-site management of each of the solid and liquid waste streams listed above.

Non-Hazardous, Municipal Waste

Non-hazardous construction waste and refuse will be placed into a municipal trash receptacle or roll-off container (20- or 30-CY) staged within the site boundaries. Full containers will be provided and transported by a local waste hauling vendor to a local waste transfer station (refer to Section 5.2).

Recyclable Waste

Wood, paper, metal, and plastic waste will be placed into separate roll-off containers (10- or 20-CY) Staged within the site boundaries. Full containers will be transported to a local waste transfer station.

Concrete or asphalt generated during demolition will be segregated and transported to a local aggregate supplier for recycling.

Non-Reusable Sampling Equipment and PPE

Non-reusable sampling equipment, PPE, and protective clothing will be handled and disposed as non-hazardous waste as discussed above.

Surplus Soils from Clean Construction Work

To the maximum extent possible, surplus soil from clean construction activities will be used onsite as common fill. Surplus soils from clean construction activities requiring off-site disposal will be temporarily stockpiled and covered with plastic sheeting. As previously discussed, the excess stockpiled soil will be sampled and analyzed for waste characterization purposes. Soil classified as non-hazardous will be disposed at the Soil Safe Logan, New Jersey landfill. All surplus soil waste shipments will be accompanied by required shipping documents.

Clearing and Grubbing Debris

Clearing and grubbing debris will be transported offsite for mulching and reuse.

Wastewater Collected from Excavations

Waste water will not be pumped from excavations but instead will be allowed to soak into the soil below the excavation. The subsoil in the area is clean sand and based on previous experiences at this site, the soil will easily allow water to infiltrate. A review of the United States Department of Agriculture Soil Conservation Service maps for the area indicates that the soil is very permeable sand and gravel outwash. The soil at a depth of 33 to 60 inches bgs has a permeability of more than 20 inches per hour.

Wastewater from Equipment Decontamination

If suspected contaminated soil is encountered (as determined from field screening), heavy equipment contacting contaminants will be decontaminated by spraying with a low volume, high-pressure (or steam) washer. Rinse water will be containerized and treated through the GWET system. Contaminated wastewater will not be discharged to the ground surface.

5.2 Off-Site Transportation and Disposal

All wastes requiring off-site disposal will be transported by licensed haulers and disposed at approved facilities.

Non-Hazardous Solid Waste

Non-hazardous waste streams, such as municipal trash, construction debris, and other non-hazardous debris, will be transported to a local transfer station for disposal at a licensed facility.

Hazardous Waste and Special Waste

In the event a waste requiring disposal at a facility permitted to accept non-hazardous or hazardous waste is generated, Mattiola Services will be subcontracted for transportation and disposal. It is also possible that one or more of the waste streams may be classified as “special waste,” defined as a non-RCRA hazardous waste that is not acceptable for disposal in a sanitary landfill, due to its chemical composition, source of generation, and/or physical form. Special wastes will also be transported and disposed of through Mattiola Services. Selection of a specific disposal facility for hazardous waste is contingent upon the quantity generated and composition of the waste material. All disposal related documents (TCLP results, manifests, etc.) will be submitted for approval by the Contracting Officer prior to waste shipment.

6.0 Spill Prevention and Control

This section presents the procedures for coordination of and response to potential spill or releases of hazardous/contaminated materials, including VOC-contaminated groundwater and operational chemical products. It is the intent to prevent all spills; however, some inadvertent releases may occur. Minor spills will generally be cleaned up by onsite personnel without formal reporting to management. Major spills will generally be deferred to local or state response authorities, and may require formal reporting to various agencies as discussed in Section 6.4.

6.1 Spill Prevention

Spill prevention during the project will be accomplished through the implementation of general control measures, secondary containment for liquid storage associated with the treatment systems, and best management practices for drum storage.

General Measures

The following measures shall be taken to minimize the possibility of spills/releases:

- Site security and controls are to be maintained so that only authorized personnel have access to work areas (refer to SSHP).
- Site personnel will be advised of appropriate spill/discharge control measures.
- Containers will remain closed except when adding/dispensing product.
- Containers will be stored upright and in an orderly fashion.
- Appropriate secondary containment structures (see below) will be used for storage of fluids on-site.
- Storage containments and piping systems will be examined daily to verify their integrity
- Treatment system design will include overflow protection and loss of pressure shut-off switches.
- Small containers of chemical product will be stored inside the job box or treatment building when not in use. Flammable products will be stored inside approved cabinets.

Secondary Containment

The design of the treatment plant includes secondary containment for liquid spills/leaks inside the building. The perimeter of the process equipment area for the building consists of a concrete berm (sill) of sufficient height to contain the 150% total fluid capacity of the equipment in the area.

Drum/Roll-off Storage Practices

A designated staging area will be established for the temporary storage of 55-gallon drums and roll-off containers. All drums will be stored on pallets within this area. Each day that field personnel are onsite, containers will be inspected for leaks, damage, corrosion, and bulging. Any container found to be leaking or on the verge of leaking due to damage or corrosion will be placed into an overpack drum or its contents will be transferred to another roll-off container.

Waste Transport Vehicles

Upon arrival of a waste transport vehicle, Arrowhead personnel shall visually inspect the condition of the waste vehicle and equipment in order to prevent spillage while on-site. Prior to leaving the site after loading, the waste transport vehicle and container shall be visually inspected for factors that may contribute to spills or releases during transport. Tarpaulins will be inspected to ensure they are secure and in good condition.

6.2 Spill Control Equipment

The following equipment and materials will be maintained at the project for use during spill response activities:

- Absorbent pads and socks
- Granular absorbent material (noncombustible)
- Polyethylene sheeting
- Shovels and assorted hand tools
- Drip pans
- 5-gallon buckets.

6.3 Spill Response

If a spill or other release of a hazardous/contaminated material occurs, the Site Supervisor and SSHO will be immediately notified. A list of contacts and telephone numbers is provided in Section 6.4.

An assessment will be made of the magnitude and potential impact of the release. As necessary, the spill will be reported in accordance with Section 6.4. If it is safe to do so, site personnel will attempt to locate the source of the release, prevent further release, and contain the spilled and/or affected materials as follows:

- The spill or release area will be approached from upwind (if outside).

- Hazards will be identified based on available information from witnesses or material identification documents (i.e., placards, SDS's). The potential hazards will be evaluated to determine the proper personal protection levels, methods, and equipment necessary for response.
- If necessary, the spill area will be evacuated, isolated, and secured.
- The spill area will be sealed off using caution tape or other appropriate means.
- Entry to the spill area will be made by personnel with the PPE, training, methods, and equipment necessary to perform the work. Hazardous spill containment and collection will be performed as follows:
 - Contain the spill with absorbent socks, booms, granules, or construction of temporary dikes. Cover or dike floor drains, storm drains, and other conduits for off-site migration of the spilled material.
 - Control the spill at the source by plugging leaks, up-righting containers, over packing containers, or transferring contents of a leaking container.
 - Collect the spilled material with shovels and other equipment as necessary.
 - Store the spilled material in drums for further treatment or disposal.
 - Decontaminate personnel and equipment after the response is complete (refer to SSHP).

If site personnel cannot safely respond to an environmental release, evacuation of the area may be warranted. In the event of a significant spill, the local fire department will be notified at **911**. Upon arrival at the site, the Site Supervisor or SSHO will brief emergency responders of the current status and potential hazards. Following a spill incident, details shall be documented in accordance with the SSHP.

Spill response will be completed using the guidelines established in the NYSDEC Spill Guidance Manual, which can be reviewed at <http://www.dec.ny.gov/regulations/2634.html>.

6.4 Spill Reporting

Minor spills, such as the slow leakage of oil from a piece of equipment located within the site boundaries, are not considered reportable spills. However, spills that occur during non-routine operations or releases outside the site boundaries, such as the inadvertent release of contaminated water to the sewer system, are reportable spills. Spills are required to be reported under 40 CFR 302, *Designation, Reportable Quantities and Notification*, if the quantity of the compound released exceeds the value listed in Table 302.4, "List of Hazardous Substances and Reportable Quantities," of the regulation. Typically, a spill of petroleum product greater than 25 gallons must be reported to State authorities. A reportable spill will also be accompanied by a standard spill incident report as per specification section 01351, paragraph 1.21, including:

- Type of release
- Source of release
- Contents of release
- Quantity of release
- Time of release
- List of whom was contacted, in order
- Any injuries incurred as a result of the release
- List of personnel involved
- Final disposition location

If a reportable quantity of a hazardous/contaminated material is released, the Site Supervisor and SSHO will be immediately notified. These individuals will then immediately notify CDM Smith and the National Response Center at **(800) 424-8802** (if the quantity of spilled material exceeds a reportable quantity). If the spill consists of petroleum product exceeds and of the following criteria it must be reported to NYSDEC, who can be reached at **(800) 457-7362**.

- The spill is known to be less than 5 gallons; and
- The spill is contained and under the control of the spiller; and
- The spill has not and will not reach the State's water or any land; and
- The spill is cleaned up within 2 hours of discovery.

In all scenarios, CDM Smith must be notified.

7.0 Indoor Air Quality

Indoor Air Quality will be protected in an effort to reduce building occupants from residual dust generated during construction activities and VOCs degassing from porous materials following construction activities. This Section defines the minimum practices which are to be employed by the project to assure a healthy work environment during construction and a healthy work environment for building occupants.

Indoor Air Quality (IAQ) measures during, and after, construction activities are based on the approach as set forth in the SMACNA standard “IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition, 2007”, and requirements of “LEED for New Construction, 2009 Edition”.

These measures will be used in conjunction with procedures and methods as discussed in the Health and Safety Plan; it is not the intent of this document to replace or supersede OSHA regulations as to safe construction workplace practices.

Procedures employed during construction will cover six areas of concern:

- HVAC system protection
- Contaminant source control
- Pathway interruption
- Housekeeping
- Scheduling
- Prior to Occupancy Flush-Out and/or Air Testing

The following describes specific measures to be performed for each area of concern:

HVAC Protection

- Ductwork will be protected and enclosed. Construction employees are to keep all supply, return and exhaust ductwork free of dust, dirt, mold and air-borne contaminants.
- All open ends of installed supply, return, exhaust ductwork or return air shaft openings are to be sealed by the mechanical contractor with plastic materials to prevent contamination, until startup or testing/operation of system.
- If the mechanical system is used during construction, provide MERV 13 filters for supply air intake when in use. Provide MERV 8 filters at the return air system openings when in use. Perform frequent maintenance when the HVAC system is being utilized and replace filters as they become loaded, prior to building flush-out, and prior to occupancy.

- When performing construction activities that produce dust, such as drywall sanding, concrete cutting, masonry work, wood sawing or adding insulation, seal off the supply diffusers and return air system openings completely for the duration of the task.
- Shut down and seal off the supply diffusers and return air ducts during any demolition operations.
- Do not use the mechanical room to store construction or waste materials. Keep room clean and neat.
- Provide periodic duct inspections during construction; if the ducts become contaminated due to inadequate protection, clean the ducts professionally in accordance with NADCA (National Air Duct Cleaning Association) standards.

Source Control

- Use low VOC products as indicated by the specifications to reduce potential problems.
- Restrict traffic volume and prohibit idling of motor vehicles where emissions could be drawn into the building.
- Utilize electric or natural gas alternatives for gasoline and diesel equipment where possible and practical. Use low-sulfur diesel in lieu of regular diesel.
- Cycle equipment off when not being used or needed.
- Exhaust pollution sources to the outside with portable fan systems. Prevent exhaust from re-circulating back into the building.
- Keep containers of wet products closed as much as possible. Cover or seal containers of waste materials that can release odor or dust.
- Protect stored on-site or installed absorptive building materials from weather and moisture; wrap with plastic and seal tight to prevent moisture absorption.

Pathway Interruption

- Provide dust curtains or temporary enclosures to prevent dust from migrating to other areas when applicable.
- Locate pollutant sources as far away as possible from supply ducts and areas occupied by workers when feasible. Supply and exhaust systems may have to be shut down or isolated during such activity.
- During construction, isolate areas of work to prevent contamination of clean or occupied areas. Pressure differentials may be utilized to prevent contaminated air from entering clean areas.
- Depending on weather, ventilation using 100% outside air will be used to exhaust contaminated air directly to the outside during installation of VOC emitting materials.

Housekeeping

- Provide regular cleaning concentrating on HVAC equipment and building spaces to remove contaminants from the building prior to occupancy.
- All coils, air filters, fans and ductwork shall remain clean during installation and, if required, will be cleaned prior to performing the testing, adjusting and balancing of the systems.
- Suppress and minimize dust with wetting agents or sweeping compounds. Utilize efficient and effective dust collecting methods such as a damp cloth, wet mop, or vacuum with particulate filters, or wet scrubber.
- Remove accumulations of water inside the building. Protect porous materials such as insulation and ceiling tile from exposure to moisture.
- Place all incidental trash into trash receptacles. Food and drinks, other than drinking water, will not be allowed in the building interior.
- Cigarette smoking, cigar smoking or chewing tobacco will not be allowed in the building.
- Thoroughly clean all interior surfaces prior to replacing filters and running HVAC system for system balancing, commissioning and building flush-out.

Scheduling and Construction Activity Sequence

- When possible, schedule high pollution activities that utilize high VOC level products (including paints, sealers, insulation, adhesives, caulking and cleaners) to take place prior to installing highly absorbent materials (such as ceiling tiles, gypsum wall board, fabric furnishings, carpet, and insulation, for example). These materials will act as “sinks” for VOCs, odors, and other contaminants, and release them later after occupancy.

Post Construction, Prior to Occupancy

- At completion of construction and prior to occupancy, temporary filtration media in all equipment are to be removed and replaced with permanent.
- A building flush-out will be performed by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.
- In the event that weather conditions prohibit the building flush-out procedures due to the inability to sufficiently heat, cool, or dehumidify the supply air, Arrowhead will contract with an independent agency to conduct baseline IAQ testing consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the LEED Reference Guide for Green Building Design and Construction, 2009 Edition.

8.0 References

Code of Federal Regulations (CFR), Title 40, Part 302, *Designation, Reportable Quantities, and Notification*, U.S. Government Printing Office, Washington, D.C.

Code of Federal Regulations (CFR), Title 40, Part 300, *National Oil and Hazardous Substances Pollution Contingency Plan*, U.S. Government Printing Office, Washington, D.C.

Code of Federal Regulations (CFR), Title 40, Part 300.435, *Remedial Design/Remedial Actions, Operation and Maintenance*, U.S. Government Printing Office, Washington, D.C.

Code of Federal Regulations (CFR), Title 40, Part 136, *Test Procedures for the Analysis of Pollutants*, U.S. Government Printing Office, Washington, D.C.



September 9, 2014

Mr. Thomas Mathew, P.E.
Project Manager
CDM Federal Programs
110 Fieldcrest Avenue
Edison, New Jersey 08837

**Subject: Contract Submittal Review – 1351-1
Old Roosevelt Field Contaminated Groundwater Area Superfund Site, Southern
Plume Plant Expansion**

Dear Mr. Mathew:

This letter presents the responses by Arrowhead Contracting to your comments on the subject submittal. Comments have been incorporated in the shop drawings as appropriate or a response has been generated as indicated in this letter.

If you have any questions or comments please contact me at (913) 814-9994.

Sincerely,

A handwritten signature in black ink that reads "Doug Ronk". The signature is written in a cursive, slightly stylized font.

Doug Ronk
Project Manager

CDM Comment:

1. Section 2.2

Are these persons listed in this section identified?

Arrowhead Response:

The personnel listed in Section 2.0 are identified in Table 2-1.

2. Section 2.6

Is Arrowhead planning to use subs? They should be identified here.

Arrowhead Response:

The section has been revised to include subcontractors.

3. Section 3.4

Is this going to be the case? What about during O&M?

Arrowhead Response:

The text has been revised to differentiate construction related work from routine operation and maintenance tasks.

4. Section 5.1

FWIW, detector tubes do not have a great ability to discern between the coc's. Something to look into. But your action levels look fine.

Arrowhead Response:

No change made to text.

5. Section 5.1

Are confined space entries expected to be part of this work?

Arrowhead Response:

We do not anticipate any confined space work will be completed. If necessary work associated with the confined space entry will be stopped until a plan is prepared, and equipment/personnel trained for confined space entry can be mobilized to the site. Text related to confined space entry has been removed from the plan.

6. Section 5.7

Is concrete cutting going to be part of work activities? What about the potential for exposure to crystalline silica during this? Dust monitoring should be included to cover any concrete cutting.

Arrowhead Response:

Concrete coring will be necessary to install new piping within the treatment plant. It is anticipated that this work will be completed using a wet coring machine.

7. Section 5.12

Is trenching below 5 feet planned for this work? Competent person shall be identified and qual's submitted.

Arrowhead Response:

Excavation will be completed below 5 feet. The Site Supervisor, Joe Cotter, will serve as the competent person (training documentation attached).

8. Section 5.17

Where will this be documented?

Arrowhead Response: (Please note, this section was incorrectly numbered and has been revised to section 5.16). Daily temperature readings will be documented in the Daily Quality Control Report.

9. Section 5.16

Where will compliance with this be documented?

Arrowhead Response: (Please note, this section was incorrectly numbered and has been revised to section 5.17). Daily temperature readings will be documented in the Daily Quality Control Report.

10. Section 5.17

If BBP are expected, will site workers receive specific BBP training?

Arrowhead Response: (Please note, this section was incorrectly numbered and has been revised to section 5.18). As noted in the third bullet point, if body fluids require cleanup the SSHO will be notified with cleanup by qualified personnel.

11. Section 9.1

I didn't think Benzene was a COC. Colorimetric tubes won't tell the difference between some of the VOC's.

Arrowhead Response: Benzene has been revised to TCE.

12. Section 9.1

You are saying 2 things here. IS it visible emissions or the dust action level?

Arrowhead Response: Text in section 9.1 and table 9-1 have been revised.

13. Section 10.7

Lightning can strike within a 60 mile radius. May want to consider a lightning detector, though it is not necessary.

Arrowhead Response: Severe weather procedures will be discussed during the initial health and safety training for all onsite personnel and reviewed during the daily tailgate meeting as needed.

14. Table 9-1

You might want to confirm if the detector tubes can determine the difference between 1,1-DCE and 1,2-DCE. It is my understanding that they do not do this very well.

Arrowhead Response: Manufacturer's data for 1-1-DCE and 1-2-DCE detector tubes are attached. Interference is noted for the 1-2-DCE tube with vinyl chloride (same detector tube as used for 1-1-DCE) at or above 300ppm.

15. Table 9-1

These should be consistent with action levels listed on page 5-2

Arrowhead Response: Table 9-1 has been revised to be consistent with the action level listed on page 5-2.



CERTIFICATE OF WEB BASED TRAINING

This is to certify that

JOSEPH COTTER

Has successfully completed

C3 Competent Person, Excavations

The course was developed and presented by ClickSafety

Serial Number: 4626889

Completed: 12/6/2010



Application & product support: INFO@SENSIDYNE.COM | 800.451.9444 / +1 727.530.3602



1,1-DICHLOROETHYLENE - Tube: 132SC

1,1-DICHLOROETHYLENE - Range: 1-22 ppm

1,1-DICHLOROETHYLENE - Range: 1-22 ppm Gas Detector Tube



Sensidyne Colorimetric Gas Detector Tubes

Measured Gas: 1,1-DICHLOROETHYLENE

Tube Number: 132SC

Range: 1-22 ppm

Tubes Per Box: 2x5 tubes

Tube Type: Standard Tube

Uses Conversion Chart: No

Operating Range: See Conversion Chart

[Download Datasheet](#)

[Buy 1,1-DICHLOROETHYLENE - Tube: 132SC Online](#)

Note: Some detector tube applications are achieved by applying a correction factor to an existing detector tube to correct the reading for the new substance. Often, these correction factors or conversion charts are provided in the detector tube's instruction sheet. If your desired correction information is not provided in the tube instruction sheet, please contact our [Customer Support](#) group for assistance.

SEARCH BY GAS NAME OR TUBE NUMBER.

RELATED LINKS

Detector Tube Pumps

Specialty Kits and Accessories

HazMat-III Kit Brochure

Detector Tubes

WATER VAPOUR - Tube: 177UR2

METHYL ISOTIOCYANATE (MITC) - Tube: 245UL

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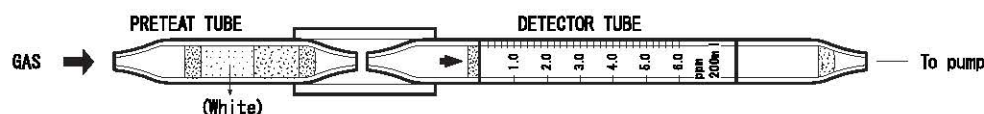


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Tube No.
132SC

VINYL CHLORIDE



1. PERFORMANCE

- 1) Measuring range : 0.4-12.0 ppm 0.2-6.0 ppm 0.1-3.0 ppm
- Number of pump strokes : 1(100mL) 2(200mL) 4(400mL)
- 2) Sampling time : 3 minutes/2 pump strokes
- 3) Detectable limit : 0.05 ppm (400mL)
- 4) Shelf life : 3 years
- 5) Operating temperature : 0~40°C
- 6) Temperature compensation : Necessary(0~20°C)(See "TEMPERATURE CORRECTION TABLE")
- 7) Reading : Direct reading from the scale calibrated by 2 pump strokes
- 8) Colour change : Yellowish green →Pink

2. RELATIVE STANDARD DEVIATION

RSD-low : 10% RSD-mid. : 10% RSD-high : 10%

3. CHEMICAL REACTION

By decomposing with an Oxidizer, Hydrogen chloride is produced and PH indicator is discoloured.
 $\text{CH}_2=\text{CHCl} + \text{CrO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{HCl}$

4. CALIBRATION OF THE TUBE

GAS CHROMATOGRAPHY

5. INTERFERENCE AND CROSS SENSITIVITY

Substance	Interference	ppm	Coexistence
Acetylene		4%	Lower readings are given.
Ethylene		400	"
Hydrogen chloride		Less than 500	The accuracy of reading is not affected.
Chlorine		50	"

(NOTE)

In case of 1 or 4 pump strokes, following formula is available for the actual concentration.
 Actual concentration = Temperature corrected value × 2/Number of strokes

TEMPERATURE CORRECTION TABLE

Scale Readings (ppm)	True Concentration (ppm)				
	0°C (32°F)	5°C (41°F)	10°C (50°F)	15°C (59°F)	20-40°C (68-104°F)
6.0	9.4	8.3	7.4	6.8	6.0
5.0	7.6	6.8	6.1	5.6	5.0
4.0	6.1	5.5	5.0	4.5	4.0
3.0	4.6	4.0	3.6	3.3	3.0
2.0	3.0	2.7	2.4	2.2	2.0
1.0	1.5	1.4	1.3	1.2	1.0



1. PERFORMANCE

- | | | | | |
|-----------------------------|---|-------------|------------|------------|
| 1) Measuring range | : 4.2-84 ppm | 9.2-184 ppm | 20-400 ppm | 42-840 ppm |
| Number of pump strokes | 4 (400mℓ) | 2 (200mℓ) | 1 (100mℓ) | 1/2 (50mℓ) |
| 2) Sampling time | : 1.5 minutes/1 pump stroke | | | |
| 3) Detectable limit | : 0.5 ppm (4 pump strokes) | | | |
| 4) Shelf life | : 1 year (Necessary to store in a refrigerated place ; 0 ~ 10 °C) | | | |
| 5) Operating temperature | : 0 ~ 40 °C | | | |
| 6) Temperature compensation | : Necessary (See "TEMPERATURE CORRECTION TABLE") | | | |
| 7) Reading | : Direct reading from the scale calibrated by 1 pump stroke | | | |
| 8) Colour change | : Yellow → Red | | | |

2. RELATIVE STANDARD DEVIATION

RSD-low : 10 % RSD-mid. : 5 % RSD-high : 5 %

3. CHEMICAL REACTION

Hydrogen chloride is produced by an Oxidizer and PH indicator is discoloured.



4. CALIBRATION OF THE TUBE

GAS CHROMATOGRAPHY

5. INTERFERENCE AND CROSS SENSITIVITY

Substance	Interference	ppm	Coexistence
Trichloroethylene	Similar stain is produced.	3	Higher readings are given.
Vinyl chloride	〃	300	〃
Hydrogen chloride	〃	10	〃
Chlorine	Pale red stain is produced.	15	〃

TEMPERATURE CORRECTION TABLE

Scale Readings (ppm)	True Concentration (ppm)	
	5 °C (41 °F)	10 °C ~ 40 °C (50 °F ~ 104 °F)
400	475	400
350	415	350
300	355	300
250	295	250
200	235	200
150	175	150
100	115	100
50	55	50
20	20	20

**SITE SAFETY AND HEALTH PLAN
REMEDIAL CONSTRUCTION ACTIVITIES
OLD ROOSEVELT FIELD SUPERFUND SITE
GARDEN CITY, NEW YORK**

SUBCONTRACT NO. 3320-048-001-CN-S

Submitted to:

**CDM Federal Programs Corporation
110 Fieldcrest Ave. 6th Floor
Edison, New Jersey 08837**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher Drive
Lenexa, Kansas 66219**

Revision 1

September 2014

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List of Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
Arrowhead	Arrowhead Contracting, Inc.
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CDM	CDM Federal Programs
CFR	Code of Federal Regulation
CHSO	Corporate Health and Safety Officer
COC	Contaminant of concern
CPR	Cardio Pulmonary Resuscitation
CRZ	Contamination Reduction Zone
DCE	Dichloroethylene
DOT	Department of Transportation
EKG	Electrocardiogram
EMS	Emergency Medical Services
FMCSR	Federal Motor Carrier Safety Regulations
GFCI	Ground Fault Circuit Interrupter
GWTF	Groundwater Treatment Facility
H&S	Health and Safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HBV	Hepatitis B virus
HIV	Human Immunodeficiency Virus
IDLH	Immediately Dangerous to Life or Health
LEL	Lower Explosive Limit
SDS	Safety Data Sheet
NIOSH	National Institute of Occupational Safety and Health
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable unit
PCE	Tetrachloroethylene
PEL	Permissible Exposure Limit
PCB	Polychlorinated Biphenyl
PPE	Personal Protective Equipment
PM	Project Manager
REL	Recommended Exposure Limit
SMAC	Sequential Multiple Analyzer Computer Profile
SSHP	Site Safety and Health Plan
SSHO	Site Safety and Health Officer
STEL	Short-Term Exposure Limit
TCE	Trichloroethylene
TLV	Threshold Limit Value
TWA	Time Weighted Average
VOCs	Volatile Organic Compounds

1.0 Introduction

This document constitutes the Site Safety and Health Plan (SSHP) for remedial construction activities at the Old Roosevelt Field Superfund Site (Site), located in Garden City, New York. Arrowhead Contracting, Inc. (Arrowhead) has prepared this document for CDM Federal Programs (CDM) under Subcontract No. 3320-048-001-CN-S. This SSHP covers construction activities specifically conducted by Arrowhead in accordance with the subcontract scope of work (SOW).

The purpose of the SSHP is to present the health and safety procedures and guidelines for protecting on-site personnel, visitors, and the public from physical harm and potential hazardous exposures during construction activities. It is intended to ensure compliance with standards established by the Occupational Safety and Health Administration (OSHA) in 29 Code of Federal Regulations (CFR) Parts 1910 and 1926, including the Hazardous Waste Operations and Emergency Response (HAZWOPER) standards (29 CFR 1910.120 and 29 CFR 1926.65). It has been prepared in accordance with CDM's subcontract requirements as outlined in *Section 01351 – Safety, Health, and Emergency Response*.

This document is intended for use by Arrowhead personnel, including Arrowhead subcontractors. The health and safety measures presented herein are in effect for the duration of the project. All project personnel are required to abide by these measures. Where not specifically mentioned, all project personnel are required to comply with applicable OSHA standards while conducting the work. The procedures and guidelines contained herein are based on best available information at the time of preparation of the SSHP. Specific requirements may be revised as new information is received or site conditions change. Any revisions to this plan will be made with the knowledge and concurrence of CDM.

1.1 Site Description

The site is located in the Village of Garden City, Nassau County, New York. The Site is located on the eastern side of Clinton Road, approximately 0.6 mile south of the intersection with Old Country Road. The Site includes a thin strip of open space along Clinton Road (known as Hazalhurst Park), a large retail shopping mall with a number of restaurants, and a movie theater. Several office buildings (including Garden City Plaza) share parking space with the shopping mall.

Two municipal water supply well fields are located south (downgradient) of the Site. The Village of Garden City public water supply wells (designated as GWP-10 and GWP-11) are located just south of the Site boundary, on the eastern side of Clinton Road. The Hempstead well field is located approximately 1.5 miles south of the Garden City supply wells. Two stormwater recharge basins are directly east and south of the mall area. The eastern basin, Pembroke, is located on the property owned by the mall. The basin to the south is Nassau County Recharge Basin number 124.

Groundwater at the Site is contaminated with volatile organic compounds (VOCs), particularly chlorinated VOCs such as tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and 1,1-dichloroethene (1,2-DCE). The highest observed concentrations in groundwater derived from Remedial Investigation (RI) and Pre-Remedial Design Investigation are as follows:

TCE	960 ug/l
PCE	300 ug/l
1,2 - DCE	69 ug/l
1,1 - DCE	23 ug/l

The remedy, as defined in the September 2007 Record of Decision (ROD), involves groundwater extraction and ex-situ treatment (pump and treat) in order to expedite the restoration of water quality in the aquifer in comparison with natural processes alone, and provide for vapor intrusion mitigation, if deemed necessary.

1.2 Field Activities

The goal of this project is to complete modification to the existing GWET system and complete one year of Operations and Maintenance of the groundwater treatment system. In accordance with the subcontract scope of work, Arrowhead crews will be performing the following field and construction-related activities:

- Installation of yard piping and well head construction
- Expansion of the treatment system
- Operations and maintenance (O&M) of the treatment system

For purposes of developing Activity Hazard Analyses (AHAs) (refer to Appendix B), field construction activities have been broken down into distinct tasks with similar H&S requirements and hazards:

- *AHA 01 – Trenching and Yard Pipe Installation*
- *AHA 02 – General Construction Activities*
- *AHA 03 – General Earthwork, Grading, and Site Restoration*
- *AHA 04 – General Site Work, Surveying, and Inspection Activities*
- *AHA 05 – On-Site Groundwater Treatment Operations*

In addition, various activities ancillary to the activities listed above will be performed, including:

- Project administration
- Site preparation, including set-up of work zones and support areas, and laydown area (i.e. for equipment/vehicle/materials storage), and utility clearances
- Personnel travel to/from the site
- Equipment cleaning and maintenance

Refer to the project Work Plan for detail related to each element of work.

1.3 HAZWOPER Applicability

During construction activities, there will be moderate potential for exposure to Contaminants of Concern (COCs) during demolition of process equipment and system proveout contaminated with VOCs. Based on previous site experience and investigative work completed by CDM, no known source of VOCs in shallow soil within the work area exists. Tasks covered under OSHA's HAZWOPER training and medical surveillance requirements found in 29 CFR 1910.120. The only tasks which the HAZWOPER rules are applicable are staff completing demolition, construction, and testing of the GWET system. Full-time site personnel involved in these activities will be required to present their HAZWOPER credentials as a pre-requisite for working at the site. Truck drivers hauling clean fill, survey crews, delivery vehicle operators, and other incidental personnel are exempt from HAZWOPER certification requirements. Electrical installation tasks are exempt from HAZWOPER certification requirements.

1.4 Arrowhead Policy Statement

It is the policy of Arrowhead to provide a safe and healthful work place for all employees, subcontractors, and clients in compliance with governmental requirements. Every associate will receive the appropriate training, equipment, and other resources necessary to complete assigned tasks in a safe and efficient manner. Subcontractors shall also be appropriately trained, participate in the necessary medical surveillance programs, and comply with the required policies, procedures, and regulations. Safety, industrial hygiene, and loss prevention are the direct responsibility of all members of management, who must create an environment in which everyone shares a concern for their own safety and the safety of other associates. Safety will take precedence over expediency or short cuts. It is a condition of employment that all employees work safely and follow established safety rules and procedures.

2.0 Organization and Responsibilities

This section describes Arrowhead personnel responsibilities for health and safety. In Table 2-1 Key Health and Safety (H&S) personnel from Arrowhead are identified.

2.1 On-Site Personnel

All on-site personnel are responsible for continuous adherence to H&S procedures during the performance of assigned work. In no case may work be performed in a manner that conflicts with the inherent safety and environmental precautions outlined in this plan. After due warning, personnel violating safety procedures will be dismissed from the site and possibly terminated from further work. Any person who observes unsafe acts or conditions or other safety problems should immediately report them to supervisory personnel.

2.2 Corporate Health and Safety Officer

The Corporate Health and Safety Officer (CHSO) has ultimate authority and responsibility for establishing, implementing and enforcing Arrowhead's H&S program. Accordingly, the CHSO develops and/or approves site-specific SSHPs, ensures that Arrowhead personnel meet applicable training and medical monitoring requirements, and develops company policies and procedures for H&S in accordance with OSHA and other applicable standards.

2.3 Project Manager

The Project Manager (PM) is responsible for coordinating the development, implementation, and enforcement of this SSHP. The PM is responsible for ensuring that the necessary resources are available for the project to be completed safely and in compliance with SSHP requirements, OSHA regulations, and other applicable standards.

2.4 Site Safety and Health Officer

The Site Safety and Health Officer (SSHO) will conduct inspections to ensure that operations are conducted in accordance with the SSHP, OSHA regulations, and the subcontract specifications. The SSHO reports directly to the PM. An open dialogue between the SSHO and the PM will be maintained in order to quickly address safety issues and implement corrective actions as necessary. The SSHO has the authority to suspend operations at the site due to the ineffectiveness of or non-conformance to this SSHP. The most senior associate will be assigned the duties of the SSHO (Alternate SSHO) when the SSHO is not on-site. Furthermore, the SSHO is also responsible for maintaining daily contact with CDM site representatives during the course of the project. The SSHO has an independent reporting line of authority to the Corporate Health and Safety Officer. This reporting authority provides for suitable checks and balances for production and safety related decisions.

2.5 Site Supervisor

The Site Supervisor is the primary safety official and emergency response coordinator at the project. The Site Supervisor is responsible for the implementation and enforcement of this SSHP in the field. The Site Supervisor is also responsible for maintaining contact with the Arrowhead PM and CDM site representatives. The Site Supervisor reports to the PM.

2.6 Subcontractors

Subcontractors are responsible for the H&S of their employees and for complying with the standards established in this SSHP and all other project requirements. The following are some of the requirements that apply to subcontractors:

- All subcontractors under the direction of Arrowhead will report to the PM.
- An assigned safety representative for each subcontractor shall be present on any day that work is being performed. The name of the assigned safety representative shall be conveyed to the SSHO.
- Subcontractors shall submit all training and medical surveillance documents to Arrowhead prior to mobilization, as applicable.
- Planned operations for the day shall be verbally conveyed to the Site Supervisor at the beginning of each day. Any changes in scopes of work or specified quantities shall also be conveyed to the Site Supervisor on a regular basis.
- The Site Entry Log shall be signed at the beginning and end of each workday by all subcontractor employees working on-site.
- All subcontractor personnel shall attend a project safety orientation (refer to Section 11.3) prior to beginning work on-site.
- All subcontractor personnel shall attend the morning tailgate safety meeting (refer to Section 11.2). If scheduling precludes attendance, then subcontractors shall hold and document their own safety meeting. Safety meeting documentation is to be submitted to the SSHO.
- All accidents, fires, injuries, illnesses, and spills shall be immediately reported to the SSHO.
- Heavy equipment is to be inspected daily by the equipment operator. Inspection documentation shall be submitted to the SSHO.
- Subcontractors are required to frequently inspect work sites for safety deficiencies and correct all deficiencies. Documentation of these inspections, as well as the corrective actions implemented, shall be submitted to the SSHO.

Arrowhead's lower-tier subcontractors for this project will include:

- Land surveyor
- Geotechnical testing
- Utility contractor
- Electrician
- Chemical testing laboratory (no onsite personnel anticipated)
- Waste disposal facility/transporter
- Treatment equipment fabricator

2.7 Visitors

All visitors shall check in with the CDM site representative to verify that all appropriate entry requirements are met. Visitors will only be allowed in support areas unless they are properly trained and equipped to enter exclusion zones / restricted areas. All visitors will be given a safety briefing upon arriving at the site.

3.0 Accident Prevention Plan

This section addresses general safety issues, rules, and miscellaneous topics associated with an Accident Prevention Plan.

3.1 Project Safety Goal

Safety is Arrowhead's highest priority. Arrowhead has established a goal of zero accidents for this project. The process of planning the project work is performed to identify, evaluate, and control the site hazards and to help realize the goal of zero accidents. All activities shall be conducted in a manner that minimizes the probability of incidents, accidents, injuries, or illnesses.

3.2 Compliance Agreements

All field personnel will receive a copy of the SSHP and read the plan prior to commencement of fieldwork. The SSHP Acknowledgment Form presented in Appendix A will be signed by field personnel after reviewing the plan and acknowledging the plan's provisions. This agreement will be retained as part of the project files.

3.3 Safety Meetings

A project-specific safety orientation meeting will be conducted by the SSHA prior to work on-site. During the meeting, an overview of the objectives of the project and the SSHP will be discussed. Additionally, a daily "tailgate" safety meeting will occur each morning prior to starting the day's field activities. All safety meetings will be documented and kept on file in the field office. Further details associated with safety meetings are provided in Section 11.0.

3.4 General Safety Provisions

The following general provisions will be in effect during **all** site activities:

- There will be no construction related activities conducted on-site without sufficient backup personnel. At a minimum, two persons (buddy systems refer to Section 3.12) must be present during site activities. Operation and Maintenance activities will be normally performed by a single plant operator. If non-routine maintenance is required (i.e. stripper disassembly and cleaning) additional staff will be mobilized.
- No loose jewelry, clothing, or long hair shall be permitted on or near equipment with moving parts.
- Except as necessary to perform the required field assignments, personnel shall avoid contact with contamination (pooled liquids, discolored areas, etc.) or any area that shows obvious evidence of contamination.
- Personnel shall not enter contaminated areas (i.e., exclusion zones) unless it is necessary.

- Field personnel must observe one another for signs of chemical exposure and or physical stress (changes in skin color, coordination, speech, breathing, etc.) and inform co-workers and management of other signs and/or symptoms (headaches, nausea, dizziness, etc.).
- Damaged personal protective equipment (PPE) or clothing will be immediately repaired or replaced.
- Smoking, eating, drinking, or any other activity involving hand-to-mouth contact while in the exclusion zone is prohibited.
- Personnel must thoroughly wash their hands and face before eating, smoking, or drinking.
- All regulated work zones (refer to Section 7.0), as established on the site, shall be observed. Entry into a restricted area or exclusion zone shall be by prior notification and authorization of the Site Supervisor or SSHO. All required PPE shall be worn prior to entering these zones.

3.5 Fire Prevention and Protection

Fire prevention and protection procedures/resources at the site include:

- **The Garden City Fire Department can be reached by dialing (516) 746-1301 or 911.**
- Fire extinguishers will be made available at the site. A minimum of one 20-pound ABC-rated fire extinguisher will be maintained at each active work area.
- Flammable materials will be stored in marked (“No Smoking”) areas with fire extinguishers available.
- Smoking will only be permitted in designated areas.
- Project personnel are only permitted to extinguish fires in their incipient stages. Fighting large fires beyond the incipient stage is prohibited by project personnel and shall only be performed by the local fire department (refer to Section 10.4).
- As necessary, hot work permits will be obtained.
- All equipment will be turned off at the end of each workday.

If emergency services are notified, Arrowhead will notify CDM immediately of the incident and the nature of the response.

3.6 Housekeeping

The following provisions are specified to maintain a high standard of housekeeping:

- The importance of housekeeping and the expectations that good housekeeping shall be maintained will be regular topics of the daily safety meetings.
- The site shall be cleaned on a daily basis.
- Subcontractors shall be informed of their responsibilities to maintain their housekeeping.

Housekeeping is an operational/safety item, which is regularly considered during routine inspections.

3.7 Heavy Equipment Inspections

All heavy mechanical equipment shall be inspected by the SSHO and Site Superintendent upon arrival at the site, and will be inspected by operator(s) on a daily basis thereafter. Daily inspections shall be documented on inspection checklists as presented in Appendix A. Deficiencies in the equipment shall be noted on the form. All inspection documentation shall be submitted to the SSHO so that repairs can be initiated. All inspection records will be kept on file in the field office (refer to Section 13.0).

3.8 First-Aid and Medical Facilities

The following provisions apply to first aid and medical facilities:

- A first-aid kit(s) will be provided and maintained on-site.
- A blood borne pathogen exposure control kit will be provided and maintained on-site.
- Emergency portable eyewash units will be maintained at work areas away from the GWET plant. The eye wash/safety shower located in the GWET plant will be used for any emergency needs during work conducted in the GWET plant.
- Emergency phone numbers will be posted on-site (refer to Table 10-1).
- The route to the **Winthrop University Hospital (516) 663-0333** will be posted on-site (refer to Figure 3-1)
- At a minimum, one on-site employee shall be certified in first aid and cardio pulmonary resuscitation (CPR) (refer to Section 11.5).

3.9 Sanitation

The following provisions will be made to address sanitation:

- Site personnel have access to a portable toilet located in the support zone (near the job / office trailer)
- Hand wash facilities will also be provided in the support zone.
- Safe drinking water will be made available as necessary to provide drinking water at individual work locations. Disposable sanitary cups shall be provided.

3.10 Security

To provide general security during field operations, the following facilities or measures will be provided:

- Temporary construction fencing, warning tape, or other appropriate barricades will be installed at the entrance to select construction work areas (i.e. open trenches) and exclusion zones. Warning/danger signs will be posted on the fencing in conspicuous locations to alert unauthorized personnel of field construction activities in progress. The boundaries of restricted areas will be established and modified by the SSHO/Site Supervisor as construction activities progress.
- Existing fence gates will remain closed at all times. Site personnel may not attempt to enter / open any gates beyond the limits of the site.

- At the conclusion of each workday, the job / office trailer will be locked. Keys to the office will only be provided to authorized personnel from Arrowhead and CDM.
- The keys to heavy construction equipment will be removed and placed inside the field/administration office at the end of each workday.
- All personnel and visitors to the site will be required to sign in and sign out as discussed in Section 7.4. Site visitors will not be allowed to enter restricted areas or exclusion zones unless approved by the Site Supervisor or SSHO.

3.11 *Illumination*

Most project operations will occur during daylight hours, between sunrise and sunset. Supplemental illumination is not anticipated.

3.12 *Communication and Buddy System*

The “buddy system” will be used at all times while working in restricted areas and exclusion zones. Personnel must maintain visual and voice communication with other personnel in the same general work area. Field crews will be equipped with two-way radios for inter-site communications. Communications with the office trailer, if it is outside vocal range, shall occur via two-way radio. All other communication shall occur via cell phones.

4.0 Activity Hazard Assessment

A hazard assessment is performed to identify the potential safety, health, and environmental hazards associated with specific field activities. It is used to determine the control measures necessary for protecting personnel, the community, and the environment. The SSHO, with input from the Site Superintendent and CHSO, will perform a hazard assessment for each major field activity to be performed during the project. Once developed, the hazard assessment may be revised when new tasks/activities are added, job situations change, or when it becomes necessary to alter safety requirements. Additions and changes to the SSHP, such as revisions to the hazard assessment, must be documented on the SSHP Amendment Form (Appendix A). Any amendment to the SSHP must have written approval from CDM. Based on the field activities listed in Section 1.2, the following H&S hazards are anticipated:

- Chemical exposure (COCs)
- Chemical exposure (operational chemicals)
- Dust
- Noise
- Fire/flammables
- Eye hazards
- Slip, trip, falls
- Operation of heavy construction equipment, inclusive of drill rigs
- Operation of small equipment and power tools
- Electrical hazards
- Hazardous energy
- Intrusive activities
- Excavation hazards
- Material handling
- Contact with hot items
- Motor vehicle hazards
- Heat stress
- Blood borne pathogens
- Environmental hazards

Table 4-1 presents a summary of these hazards as they apply to the project construction. Appendix B presents the Activity Hazard Assessment for this scope of work – a breakdown of the H&S hazards associated with the primary field activities and the control measures that will be implemented to eliminate or minimize these hazards. Hazard control measures are discussed in detail in Section 5.0.

5.0 Hazard Control Measures

There are numerous chemical, physical, environmental and industrial hazards associated with the project. These hazards, if not properly controlled, can cause harm to project personnel, visitors, and the public. This section, combined with the remaining sections of this SSHP, address the recommended measures for controlling or minimizing the hazards. These control measures are summarized in Table 5-1.

5.1 Chemical Exposure

For purposes of this SSHP, chlorinated VOC compounds (CVOCs) including trichloroethene (TCE), tetrachloroethene (PCE), cis-1,2-dichloroethene (cis-1,2-DCE), and 1,1-DCE are the primary contaminants of concern (COCs) for this project. The presence of VOC's in groundwater will drive requirements for PPE, site control, and air monitoring. The following table presents the maximum estimated groundwater concentrations for select COCs based on CDM's Site Health and Safety Plan.

COC	Maximum Estimated Influent Water Quality (ug/L)
TCE	960
PCE	300
Cis-1,2-DCE	69
1,1-DCE	23

Based on conversations with CDM Project personnel, Arrowhead understands that the shallow soil within the limits of the proposed construction area is not contaminated with the COCs. Although the soils at this particular job site are not believed to be impacted by COCs, Arrowhead has addressed the potential for soil contamination in the context of this plan.

The only activities that will result in the disturbance of contaminated media (groundwater) will occur during demolition of process equipment, equipment installation, prove-out, and operation of the pump and treat system. Consequently, activities associated with these aspects of the work will potentially expose construction crews and public receptors to the following environmental hazards and exposure pathways:

- Dermal exposure to VOC-contaminated groundwater
- Inhalation exposure to VOCs from contaminated groundwater

Inhalation exposure to contaminated groundwater is considered significant due to the high volatility of CVOCs during sampling or unforeseen spills of contaminated groundwater during prove-out and operations activities.

Dermal exposure to contaminated groundwater is considered significant during sampling or unforeseen spills of contaminated groundwater during prove-out and operations activities.

Dermal contact exposure will be controlled through the use of appropriate personal protective equipment as discussed in Section 6.0. Inhalation exposure hazards will be controlled through the implementation of the following control measures:

- Compliance with site-specific action levels (see below)
- VOC air monitoring and sampling (refer to Section 9.0)
- Engineering and administrative controls for dust suppression (refer to Section 5.2)
- PPE and, as needed, respiratory protection (refer to Section 6.0)

Action Levels – VOCs

To assess worker exposure to VOCs released from contaminated media, Arrowhead will perform real-time air monitoring using a photoionization detector (PID) and detector tubes. The highest in-situ groundwater concentrations are associated with TCE and PCE. Based on the PELs for these compounds, Arrowhead has established a site-specific action level (total organic vapors) of **15 ppm** for upgrading PPE and a stop work action level of **25 ppm** (refer to Table 9-1). In addition detector tubes will be used to monitor for 1,1-DCE, which has a stop work limit of 1ppm. To augment real-time air monitoring, Arrowhead may perform time-integrated air sampling for TCE and PCE. Air sampling data will be used to calculate time-weight average (TWA) exposures to specific compounds.

Action Levels – Particulates

Consistent with Arrowhead's experience at other sites where nuisance dust will be generated as a byproduct of construction activity, Arrowhead recommends a tiered action level approach based on permissible exposure limits for nuisance / total dust. At ambient dust levels between 5 mg/m³ (OSHA PEL for respirable dust) and 10 mg/m³, engineering controls will be increased in an effort to maintain dust levels safely below 5 mg/m³. If ambient dust levels exceed 10 mg/m³ (sustained for more than one minute), a stop work order will be issued. Personnel will be required to evacuate the area until conditions improve. In extreme circumstances only, personnel will be required to upgrade to Level C PPE. In summary, the following action levels will guide decision-making during construction activities involving disturbance of COC-contaminated soil:

- **“Take Action Level” – 5 - 10 mg/m³** – increase engineering controls (refer to dust control measures below)
- **“Stop Work Level” – > 10 mg/m³ (sustained for more than one minute)** – stop work until dust levels subside
- **“Upgrade Action Level” – prolonged ambient dust concentrations > 10 mg/m³** – upgrade PPE to Level C until dust levels subside

Real-time dust monitoring will be conducted during construction activities at the site to document actual field conditions. Should dust control measures fail to reduce readings to less than the dust monitoring upgrade level (10 mg/m³), the level of protection will be upgraded to Level C or work stopped until particulate levels subside.

COC Toxicology and Exposure Limits

The following is a brief summary of the general health effects (from overexposure) and exposure limits for the primary COCs at the Site.

- **Trichloroethylene (TCE).** Trichloroethylene is a chlorinated hydrocarbon often used as a metal degreasing agent. Exposure to TCE targets the eyes, respiratory system, heart, CNS, liver, kidneys, and skin. Symptoms of exposure include headache, visual disturbance, tremors, nausea, vomiting, eye irritation, dermatitis, heart arrhythmias, liver injury, vertigo, drowsiness, and tingling in the extremities. Trichloroethylene is considered an occupational carcinogen. (PEL: 100 ppm, 200 ppm ceiling, 300 ppm 5-minute max peak in any 2 hrs; IDLH: [Ca] 1,000 ppm; TLV: 50 ppm, 100 ppm STEL.)
- **Tetrachloroethylene (PCE).** Tetrachloroethylene or perchloroethylene is a chlorinated hydrocarbon used as a vapor-degreasing solvent and a drying agent for metals. Exposure to tetrachloroethylene targets the liver, kidneys, respiratory system, eyes, skin, and CNS. Symptoms of exposure include irritation to the eyes, nose, and throat; nausea; flushed face and neck; dizziness; in coordination; sleepiness; redness to the skin; and liver damage. Tetrachloroethylene is considered an occupational carcinogen. (PEL: 100 ppm, 200 ppm ceiling, 300 ppm 5-minute max peak in any 3 hrs; IDLH: [Ca] 150 ppm; TLV: 25 ppm, 100 ppm STEL.)
- **1,2-Dichloroethene (1,2-DCE).** 1,2-Dichloroethene is a chlorinated hydrocarbon used as an extraction solvent. Exposure to 1,2-dichloroethene targets the eyes, respiratory system, and CNS. Symptoms of exposure include irritated eyes and respiratory system (i.e., nose, throat, lungs), and CNS depression. (PEL: 200 ppm, IDLH: 1,000 ppm; TLV: 200 ppm.)
- **1,1-Dichloroethene (1,1-DCE).** 1,1-Dichloroethene is a chlorinated hydrocarbon used as an extraction solvent. Exposure to 1,1-dichloroethene targets the eyes, skin, throat, and lungs. Symptoms of exposure include irritated eyes, skin, and throat and breathing difficulty. (PEL: No OSHA PEL, IDLH: > 500 ppm; TLV: 1 ppm.)

As a reference to the end-users of this SSHP, brief definitions of the important chemical exposure limits are provided below.

- **Threshold Limit Value (TLV)** - Airborne concentrations of substances, generally expressed as an eight-hour time weighted average (TWA) and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day for a 40-hour work week without adverse health effects. Threshold limit values are guidelines for occupational exposures established by the American Conference of Governmental Industrial Hygienists (ACGIH) (1998).
- **Permissible Exposure Limit (PEL)** - the 8-hour TWA, short-term exposure limit (STEL), or ceiling (C) concentration above which workers cannot be exposed. PELs are enforceable by OSHA.
- **Recommended Exposure Limit (REL)** - the up to ten-hour per workday, TWA exposure recommended by the National Institute of Occupational Safety and Health (NIOSH).
- **Immediately Dangerous to Life or Health (IDLH)** - Concentration that poses an immediate threat to life or produces irreversible, immediate debilitating effects on health (American National Standards Institute). NIOSH defines IDLH as air concentrations, which represent the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.

Operational Chemicals

In addition to the site contaminants, there is also a potential for exposure to operational chemicals used during the project. Since most of these chemicals are in liquid form, the primary means of exposure to these hazards is inhalation and dermal contact. Hazardous chemicals (such as diesel fuel and lubricants) will be brought on-site for use during the project. The use of operational chemicals is regulated by OSHA under the Hazard Communication Standard (29 CFR 1910.1200). Arrowhead's *Hazard Communication Program* provides requirements for the safe use of operational chemicals, including the requirement to maintain Safety Data Sheets (SDSs) on-site for each chemical product. Exposure to operational chemicals will be controlled by using the products in the manner recommended by the manufacturer, donning appropriate PPE, ensuring that chemical containers are properly labeled, and storing the products in approved containers and cabinets. Additionally, daily inspections will be performed to ensure safety storage practices, the integrity of chemical containers, and the accessibility of SDSs. The inspections will be documented on a daily safety inspection checklist (Appendix A).

5.2 Dust

During construction operations, there is potential for nuisance dust to be generated and dispersed. The generation of dust shall be prevented when possible and controlled when necessary. Work practices shall be adjusted in a manner to minimize dust generation. During construction activities and dust level will be monitored by the SSHO using visual inspection, with the goal of zero visible dust. If dust levels

cannot be maintained at the goal, Arrowhead will increase appropriate engineering and/or administrative control measures, including, but not limited to:

- Minimizing material free-fall from excavation equipment (e.g., loaders and excavators)
- Water spraying exposed soil during excavation, taking care to avoid overspraying
- Water spraying loads when receiving backfill materials, taking care to avoid overspraying
- Water spraying backfill material stockpiles
- Covering backfill stockpiles with plastic sheeting
- Stopping or restricting work activities when dust levels become elevated or when the wind speed is excessive
- Positioning personnel upwind

The enclosed cabs of some heavy equipment will further protect operators from dust exposure. The key to safety will be suppressing the dust using water and maintaining a safe distance from visible dust emissions.

5.3 Noise

The primary source of elevated noise levels during the project will be the operation of heavy construction equipment. Noise levels may exceed the OSHA PEL of 85 decibels, particularly in the immediate vicinity of heavy equipment. Hearing protection will be required when operating heavy construction equipment that does not have an enclosed cab. At the SSHO's discretion, noise monitoring may be performed to ensure that noise levels are below permissible limits at the site boundaries and at the location of nearby receptors. It is not anticipated that noise levels will be a hazard beyond the site boundaries.

5.4 Eye Hazards

The potential for eye injuries is high for most construction activities. Eye hazards include projectiles, fumes, dust, heat, and glare. The specific eyewear that will be used to protect workers from these hazards will include:

- Safety glasses with side-shields – all operations except office administration
- Goggles – upgrade for high levels of dust or for splash hazards, as deemed necessary by the SSHO
- Face shields (used with safety glasses) – upgrade for splash hazards, as deemed necessary by the SSHO;

All protective eyewear will meet American National Standards Institute (ANSI) Z87.1 standards. Furthermore, at least one eyewash station will be available near the primary work area.

5.5 Slips, Trips, and Falls

During the project, conditions such as uneven ground surface and other obstructions will create a general slip, trip, and fall hazard for field personnel. The following general provisions shall apply to the prevention of slips, trips, and falls:

- Excavation safety zones will be established to delineate safe approach limits and observation access points to avoid fall hazards inherent with excavation operations.
- Personnel shall keep working areas clean and orderly. Tools, equipment, and materials shall be used and stored in a fashion to minimize tripping hazards.
- Small, loose items such as tools and other small objects shall not be left on the ground surface.
- Spills shall be cleaned up immediately (refer to Section 10.5).
- Personnel using hand and mechanical tools shall position themselves properly and consider the events if a tool slips or suddenly moves.
- Personnel shall not walk or climb on equipment not designed as walking surfaces.
- Electrical extension cords and electrical wiring shall be kept clear of walking and working areas and/or covered or otherwise secured.
- Walking and working surfaces shall be kept clean.
- Running is prohibited.

5.6 Fire Hazards

The potential for fire explosion hazards at the site is associated with the storage and use of flammable liquids (i.e. diesel fuel). The following provisions shall apply to the storage and use of flammable liquids:

- Flammable liquids shall be kept away from ignition sources (such as coring equipment and generators)
- Flammable liquids shall be used and stored only in areas with good ventilation.
- Containers shall be stored in approved, metal containers.
- Containers shall be grounded and bonded when transferring liquids to safely discharge static electricity.
- Spills shall be immediately cleaned up and reported to CDM.

5.7 Operation of Heavy Construction Equipment

Numerous types of heavy equipment will be used/operated during construction, including an excavator and compactor, among others. All operators of heavy equipment shall be familiar with the requirements for inspection and operation of the equipment. Before equipment is placed into use and on a daily basis, the operator is to inspect and verify that it is in safe operating condition. The heavy equipment

inspections shall be documented on the inspection checklists provided in Appendix A. The following general safety guidelines shall be followed while operating heavy equipment:

- Equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded.
- Getting on or off any equipment while it is in motion is prohibited.
- Equipment will be operated in accordance with the manufacturer's instructions and recommendations.
- All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Equipment designed to be serviced while running are exempt from this requirement.
- Buckets, blades, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls shall be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.
- No guard, safety appliance, or device will be removed from machinery or equipment, or made ineffective except for making immediate repairs, lubrications, or adjustments, and then only after the power has been shut off. All guards and devices will be replaced immediately after completion of repairs and adjustments and before power is turned on.
- Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shut-off which prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.
- Each piece of heavy equipment and other similar equipment will be equipped with at least one dry chemical or carbon dioxide fire extinguisher with a minimum rating of 10-pound ABC.
- Personnel will not work, pass under, or ride in the buckets or booms of loaders in operation.
- All self-propelled construction equipment, whether moving alone or in combination, shall be equipped with a reverse signal alarm.
- Seat belt use is required while operating equipment.

Spotters for the operator will be the only personnel allowed in the vicinity of the heavy equipment. Spotters shall stay out of the boom radius area. Personnel needing to approach heavy equipment while operating shall observe the following protocols:

- Make eye contact with the operator (and spotter).
- Signal the operator to cease heavy equipment activity.
- Approach the equipment only after the operator has given signal to do so.

The following general safety provisions shall apply to the operation of walk-behind concrete saws:

- Eye protection and hearing protection are required.
- Blade guards must be present and functioning properly. Inspect blades regularly.
- Do not use dull or loose blades.
- Inspect lines/hoses, switches, water pump, etc. for damage and proper operation.

- Lockout practices (refer to Section 5.10) must be implemented when changing out saw blades. That is, the source of power must be turned off and in control of the worker changing out the blade.
- Power cords shall be used with ground fault circuit interrupters (GFCIs).
- Barricade the immediate saw cutting area. Keep unauthorized personnel from entering barricaded areas.
- Operators shall maintain firm footing and balance.

5.8 Operation of Small Equipment and Power Tools

Hand and power tools shall be used, inspected, and maintained in accordance with the manufacturer's instructions and recommendations and will be used only for the purpose for which designed. The following requirements shall be followed:

- The tool housing will be checked to be sure it is in good condition (i.e., free of cracks and defects).
- If provided, trigger locks (to prevent accidental activation) will be checked for proper function prior to using the tool.
- Tools designed to accommodate guards will be equipped with the guards when in use.
- Reciprocating, rotating, and moving parts of equipment shall be guarded whenever possible if exposed to contact by workers.
- Moveable guards shall operate freely.
- Tools shall be inspected to ascertain safe operating condition and are to be kept clean and free of accumulated dirt.
- Electric power tools and extension cords shall be used with ground fault circuit interrupter (GFCI).
- If the tool is not three-wire ground protected, it will be double-insulated.
- Portable power cords will be designated as hard usage or extra hard usage and shall not be used if damaged, patched, oil-soaked, worn, or frayed.
- For pneumatic power tools, compressed air hoses will be in good condition (no visible cracks, bubbles, or kinks) and hose connections shall be secured such that there are no noticeable air leaks.
- Hydraulic tools will be checked to be sure there is no fluid leakage, hydraulic lines are in good condition (no visible cracks, bubbles, or kinks), and connections are secure.
- The motor, muffler, spark plugs, and other components of gasoline-powered tools will be checked to be sure they are in good condition. The tools will also be checked for signs of fuel leakage around the gasoline tank or fuel line.

5.9 Electrical Hazards

Some of the work may occur near overhead power / communication lines. In accordance with OSHA standards (29 CFR 1926.550 and 1910.33), a minimum clearance of 10 feet must be maintained between mechanical equipment (such as cranes and drill rigs) and energized overhead power lines. This clearance

distance must be increased by four inches for every 10 kV over 50 kV. If it necessary to approach closer than 10 feet from a power line, one of the two following options will be implemented in accordance with the OSHA standard:

- The line will be will be de-energized and grounded.
- An insulating barrier will be erected to prevent contact with the line. The barrier must be rated for the voltage of the line to be guarded.

Arrowhead will strive to maintain the minimum clearance distances (at least 10 feet) from overhead power lines. During operations near overhead power or communication lines, one person involved in the operation (or the SSHO) will be assigned the duty of “observer” to visually monitor the operation and provide timely warning to equipment operators in the event the minimum clearance distance is violated. In accordance with OSHA standards, the observer will be positioned “so as to be able to visually monitor the clearance between the equipment and power lines.” The observer cannot be assigned other duties that would interfere with the ability to provide safety oversight and time warnings.

Applicable standards for electrical power 29 include CFR 1926 Subpart K. The following general electrical safety provisions shall apply during construction:

- All portable electrical equipment and extension cords shall be protected with a GFCI as part of the circuit.
- Use only three-wire ground protected or double insulated power tools.
- If a tool is not three-wire ground protected, it will be double-insulated.
- Wear rubber-soled shoes/boots and rubber gloves when using tools in wet locations.
- To the extent practical, suspend cords above head height when it is necessary to have them across aisles or traffic areas. If cords are placed across aisles or traffic areas for prolonged periods of time, place protective strips over the cord(s).
- Do not hang cords over nails, bolts, or sharp edges.
- Replace damaged or frayed power cords immediately.
- Immediately discontinue the use of tools that shock, smoke, smell or spark.

5.10 Hazardous Energy

The potential for releasing hazardous energy is a significant concern due to the following conditions:

- Utility lines that could become breached during site work
- Release of hazardous energy during maintenance or service of equipment and tools
- Energized appurtenances associated with the antenna field

To minimize the potential for releasing hazardous energy from live utility lines, the following site-specific procedures will be implemented:

- Lockout/tag out procedures – de-energize, depressurize, or isolate energized lines and equipment, as necessary
- Safe excavation methods – refer to Sections 5.11 and 5.12
- Maintaining safe distances from energized utility lines and appurtenances

Lockout/tag out procedures (referencing 29 CFR 1926.417) will also be implemented during servicing or maintenance of equipment to preclude the unexpected start-up and/or release of stored energy. To prevent the accidental start-up of equipment while a person's hands are near a hazardous location (i.e., point-of-operation, rotating belts, gears), the operator must turn off the power to the machine and apply a lock or otherwise control the power source to ensure that the equipment cannot be inadvertently energized.

5.11 Intrusive Activities

Before any intrusive activity (excavation) begins, positive steps shall be taken to determine the locations of underground utilities. Personnel shall always be alert for marking tape, wires, pipes, previously disturbed soils, crushed stone or sand bedding/backfill, discolored soil, and other indications of the presence of buried utility lines. The following procedure shall be followed to identify the locations of buried utilities prior to commencing intrusive activities. Intrusive activities shall not begin until the SSHO / Site Supervisor have signed off on the Utility Clearance Form and have issued an Intrusive Activities Permit. Both of these forms are provided in Appendix A.

- The SSHO shall contact **New York City / Long Island One-Call (1-800-272-4480)** to notify them of intent to initiate intrusive activity at the given property location. This notification is to be made a minimum of two working days prior to the initiation of intrusive activity.
- The SSHO will ensure that underground utilities have been located and marked on the ground (using stakes, flags, and/or spray paint).
- The SSHO shall document utility clearances on the Utility Clearance Form (Appendix A).
- Once the clearance process is completed, the SSHO will issue an Intrusive Activities Permit (Appendix A). The signatures of the SSHO / Site Supervisor shall be obtained on the Clearance Permit before beginning intrusive activities.
- A safety meeting shall be held by all personnel involved in intrusive activities prior to initiating work.
- Prior to beginning any drilling activities each boring location will be hand excavated to a depth of 5 feet to confirm utilities do not exist in the area.

5.12 Trenching Hazards

For trenches exceeding 5 ft bgs, the depth below which protective systems are required under 29 CFR 1926 Subpart P (OSHA Excavation Standard), ***Arrowhead will slope or bench the side walls of these excavations in accordance with 29 CFR 1926 Subpart P, Appendix B, Table B-1.*** Where sloping or benching may not be achievable, Arrowhead's alternate approach will be to use a trench box.

Soil Classification

The soils encountered during trenching activities are assumed to sand. As a non-cohesive material, site soils will initially be classified as “Type C” under the OSHA Excavation Standard, and will require sloping at a maximum of a 1.5:1 ratio. Arrowhead’s competent person will inspect the excavation daily, and if necessary will increase the side slopes.

Competent Person

In accordance with 29 CFR 1926.650, daily inspections of open trenches shall be made by a competent person. Arrowhead’s Site Supervisor will serve as the competent person during trenching activities at the site. Daily inspections of trenches, the adjacent areas, and protective systems shall be made by the competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. The inspection shall be documented (refer to the attached Trench/Excavation Inspection Checklist) prior to the start of work and as needed throughout the shift. When personnel are required to enter the excavation, inspections shall also be made after rain storms or other hazard increasing occurrence.

Sloping

When utilized, the sidewalls of trenches will be sloped in accordance with Appendix B, Table B-1 of Subpart P. For purposes of slope design, the soil type at the site (referencing Appendix A of Subpart P) is assumed to be Type C. The maximum allowable slope for Type C soil is 1.5:1 (H:V) as specified in Table B-1 of the OSHA standard:

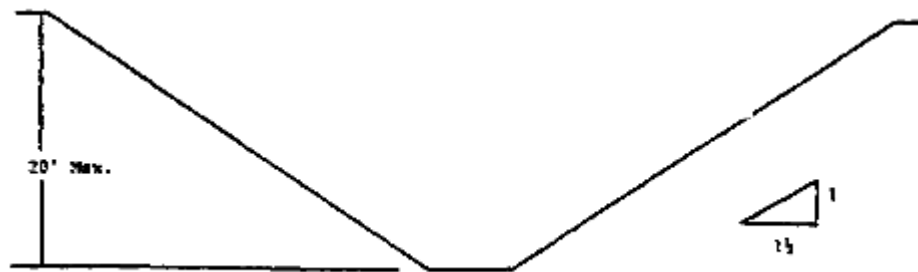
**TABLE B-1
MAXIMUM ALLOWABLE SLOPES**

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)(1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP(3)
STABLE ROCK	VERTICAL (90°)
TYPE A (2)	3/4:1 (53°)
TYPE B	1:1 (45°)
TYPE C	1 ½:1 (34°)

Arrowhead will construct a “simple slope” configuration in general accordance with Figure B-1.2 (see example illustration below). The specific configuration may be altered slightly in the field to avoid / protect structures and appurtenances.

FIGURE B-1.2 Excavations Made in Type C Soil

All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1.5:1 and maximum bench dimensions as follows:



SIMPLE SLOPE

Specific Requirements

All spoils shall be placed at least 2 feet from the edge of the trench.

Appropriate barriers (barricades, construction fencing, or warning tape) will be erected at the perimeter of open trenches. The barriers will be placed at a distance not closer than 6 feet (when possible) from the edge of the trench.

All project personnel shall participate in the site-specific training session and be instructed on the following requirements:

- Before commencing trench work, the existence and location of underground pipes, electrical equipment, telephone, gas lines, etc. shall be determined and documented as discussed in Section 5.11 of the SSHP.
- Operations shall be suspended and ignition sources eliminated if a hazardous atmosphere is encountered or suspected.
- If excavating equipment is being operated in the vicinity of overhead power lines, minimum clearance distances from energized overhead electric lines will be maintained or the lines will be grounded or guarded.

5.13 Material Handling

Various materials and equipment may be handled manually during project operations. Care should be taken when lifting and handling heavy or bulky items to avoid back injuries. Additionally, workers may

be exposed to injury from handling materials with sharp edges and from inadvertently dropping materials with slippery surfaces.

The following fundamentals address the proper lifting techniques that are essential in preventing back injuries:

- The size, shape, and weight of the object to be lifted shall first be considered. No individual employee is permitted to lift any object that weighs over 50 pounds. Multiple employees or the use of mechanical lifting devices are required for objects over the 50-pound limit.
- The anticipated path to be taken by the lifter should be inspected for the presence of slip, trip, and fall hazards.
- The feet shall be placed far enough apart for good balance and stability (typically shoulder width).
- The worker shall get as close to the load as possible. The legs shall be bent at the knees.
- The back shall be kept as straight as possible and abdominal muscles should be tightened.
- Twisting motions should be avoided when performing manual lifts, i.e., auger flights.
- To lift the object, the legs are straightened from their bending position.
- A worker shall never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting. The legs are bent at the knees and the object lowered.
- For high loads, position the body as close as possible to the load, slide the load towards you, and lift with the arms and legs (not the back).

When two or more workers are required to handle the same object, coordination is essential to equally divide the weight between the individuals carrying the load and to make a uniform lift. When carrying the object, each worker, if possible, shall face the direction in which the object is being carried. Additionally, each worker shall lift, walk, and lower the load together. When carrying loads on the shoulder, each worker shall carry the load on the same shoulder, walk in step, and put the load down together.

To protect the feet and hands from injury, field personnel will be required to wear steel-toed boots and leather gloves, respectively, while performing construction operations.

5.14 Contact with Hot Items

Contact with hot equipment, such as exhaust pipes of gas-powered equipment, hot water from steam sprayer, generators, and equipment tooling, may subject field personnel to burns. Field work will be monitored by the SSHO to ensure that workers are either avoiding hot equipment or are using safe work practices to prevent contact with hot equipment. Safe work practices will include the use of PPE (i.e., leather gloves, face shields, protective suits), as necessary, and allowing equipment to cool off before

making contact with affected components. In the event a worker is burned, the following procedure will be followed:

- Cool the burned area with cool water and cool, wet cloths.
- Expose the area, but do not remove clothing that sticks.
- Cover with dry, sterile dressings or clean cloth.
- Do not break blisters, apply ointments, or try to clean third degree burns.

5.15 Motor Vehicle Hazards

Commercial carriers for waste materials destined for disposal shall meet Federal Motor Carrier Safety Regulations (FMCSRs) promulgated by the Department of Transportation (DOT); including, vehicle inspection, repair, and maintenance requirements. Drivers operating commercial vehicles shall comply with all federal, state, and local traffic regulations, including “hours of service” requirements found in 49 CFR Part 395. Drivers shall inspect vehicles as required and maintain records of the inspections. Vehicles must be in good condition, safe to operate, and are in compliance with Federal Motor Vehicle Safety Standards (49 CFR Part 571).

All personnel shall drive defensively and wear seat belts while vehicles are in motion. Since backing accidents at these types of projects are frequent, the following guidelines shall be observed:

- Backing of vehicles shall be avoided when possible. Extra care shall be taken to back vehicles when unavoidable.
- When parking vehicles, vehicles shall be backed into the space whenever possible.
- Before backing a vehicle which has been parked, the driver shall physically walk to the back of the vehicle to observe the area before entering the vehicle.
- Spotters shall be used to back vehicles whenever possible.

5.16 Cold Stress

The adverse effects of cold weather are a concern during the winter months. While hypothermia should be recognized as a potential hazard, the highest probability of worker injury is though frost-bite. Workplace monitoring shall begin where the environmental temperatures fall below 60.8°F so that the ACGIH Cold Stress standard (TLV) can be applied. Control measures to prevent adverse physiological affects from cold weather should be implemented prior to the exhibition of any signs or symptoms.

Frostbite occurs when the extremities do not get sufficient heat from the central body stores. The fluids around the cells of the body tissues can freeze from exposure to low temperatures. This freezing can result in damage and loss of tissue. The most vulnerable areas for frostbite are the nose, cheeks, ears, fingers, and toes. Skin and tissue damage from frostbite can result in scarring, tissue death, permanent loss of movement, or amputation. There are three degrees of frostbite:

- First Degree - Freezing without blistering or peeling
- Second Degree - Freezing with blistering or peeling
- Third Degree - Freezing with skin tissue death and possible deeper tissue damage.

Symptoms of frostbite include:

- Skin color changes to white or grayish-yellow, to reddish-violet, and finally black as the tissue dies
- Coldness or numbness of the affected part
- Pain may be felt at first, but subsides.

Hypothermia, or a drop in body core temperature, is a dangerous condition resulting from cold stress. Employees should be protected from exposure to cold so that their deep-core body temperature does not fall below 97.6° F. A lower body temperature can result in reduced mental alertness, reduction in rational decision-making, or loss of consciousness with the threat of fatal consequences. The symptoms of hypothermia are:

- First, uncontrollable shivering and the sensation of cold
- Heartbeat slows and may become irregular
- Pulse weakens and the blood pressure changes
- As the body's core temperature drops, other signs may include cool skin, slow irregular breathing, slurred speech, loss of coordination, and apparent exhaustion
- The victim may become listless, confused, exhibit severe shivering, or develop severe pain in the extremities
- The advanced/final signs of hypothermia are a significant drop in blood pressure, fatigue, shallow respiration, coma, and death.

When the ambient air temperature falls below 36° F (inside or outside the building), the following requirements shall apply:

- If wind chill is a factor, the cooling effect of the wind shall be reduced by shielding the work area or providing employees an outer wind breaking layer of clothing.
- Extremities (i.e., fingers, ears, toes, and nose) shall be protected from extreme cold by protective clothing.
- Employees performing light work and whose clothing may become wet shall wear an outer layer of clothing that is impermeable to water.
- Employees performing moderate to heavy work and whose clothing may become wet shall wear an outer layer of clothing that is water repellent.
- Outer garments shall provide for ventilation to prevent wetting of inner clothing by sweat.
- If clothing is wet, the employee shall change into dry clothes before entering a cold environment.
- Workers shall change socks and removable felt insoles at regular daily intervals or use vapor barrier boots.

- Workers who become immersed in water or whose clothing becomes wet shall immediately be provided a change of clothing and be treated for hypothermia if necessary. If the clothing becomes wet from sweating, the employee may finish the task that caused the sweating before changing into dry clothes.
- Metal handles of tools and control bars will be covered by thermal insulating materials when temperatures fall below 30° F.

Individuals or coworkers expressing the symptoms of hypothermia or frostbite shall notify the SSHO or Field Supervisor immediately. At the onset of cold related illness, activities must be halted and treatment initiated. Early detection and treatment of hypothermia or frostbite will prevent further serious illness or injury.

Frostbite can be alleviated by having the affected body parts gently warmed with room temperature water. Never rub frostbitten skin. Seek medical attention for all but the mildest cases of frostbite. In a hypothermic situation, the body must be warmed immediately to prevent severe injury or death - medical attention must be immediately obtained. To warm up the affected person's body:

- Bring affected person to a warm room
- Remove impermeable PPE and wet clothing
- Wrap person in warm coats
- Have them drink warm liquids, if conscious.

5.17 Heat Stress

Heat stress is a concern even for work conducted during cool weather months. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, PPE, workload, and individual characteristics. Heat stress can cause physical discomfort, loss of efficiency, or personal illness/injury. Reduced work tolerance and the increased risk of heat stress are directly influenced by the amount and type of PPE worn. PPE adds weight, bulk, reduces the body's capability for thermoregulation (i.e., evaporation, convection, and radiation), and increases energy expenditure.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur - ranging from mild to fatal. These physical reactions to excessive heat include:

- Heat rash is caused by continuous exposure to heat and humidity and aggravated by chafing clothes. Heat rash decreases the body's ability to tolerate heat in addition to being a nuisance.
- Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. Heat cramps cause painful muscle spasms and pain in the extremities and abdomen.
- Heat exhaustion is caused by increased stress on various organs to meet increased demand to cool the body. Heat exhaustion causes shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness.

- Heat stroke is the most severe form of heat stress. Heat stroke symptoms include hot, dry skin; no perspiration; nausea; dizziness; confusion; strong, rapid pulse; coma; and sometimes death. **Heat stroke is a serious medical emergency. The affected person shall be cooled down rapidly and medical attention must be given immediately.**

The following practices will help prevent heat stress:

- Acclimatize workers to hot working conditions.
- Provide plenty of liquids to replace the body fluids lost by perspiration. Fluid intake should be forced because, under conditions of heat stress, the normal thirst mechanism is not adequate to bring about a voluntary replacement of lost fluids.
- Provide personal cooling devices.
- Conduct strenuous field operations in the early morning.
- Rotate personnel to various job duties
- Establish adequate work/rest cycles.

Individuals or coworkers expressing the symptoms of heat stress shall notify the SSHO or Site Supervisor immediately. **At the onset of heat related illness, activities must be halted and treatment initiated.**

Early detection and treatment of heat stress helps to prevent further serious illness or injury. Individuals that have experienced heat related illness can become more sensitive and predisposed to additional heat stress related problems.

Heat exhaustion can be alleviated by having the affected person rest in a cool, shaded location and have them drink cool water. **In a heat stroke situation, the body must be cooled immediately to prevent severe injury or death - medical attention must be immediately obtained.** To cool down the affected person's body:

- Remove impermeable PPE
- Remove worker from the hot environment.
- Apply copious amounts of cool (not cold) water to the body
- Have the person drink cool water, not cold, if conscious.

Adequate work/rest periods shall be implemented as necessary to prevent heat stress on personnel.

However, since individuals vary in their susceptibility to heat stress, field personnel will be reminded to perform physiological monitoring to aid in measuring individual response to heat stress. Physiological monitoring will become applicable when ambient temperatures exceed 70 °F. Each individual will have the option of monitoring one of the following physiological parameters:

- **Heart Rate.** Each individual will count his/her radial (wrist) pulse for 30 seconds as early as possible in the first rest period. If the heart rate of any individual exceeds 100 beats per minute at the beginning of the rest period, then the work cycle shall be decreased. The rest period will remain the same.

- **Temperature.** Each individual will measure his/her body temperature with an ear thermometer as early as possible in the first rest period. If the temperature exceeds 99.6 °F at the beginning of the rest period, then the work cycle shall be decreased. The rest period will remain the same.

An individual is not permitted to return to work if his/her body temperature exceeds 100.6 °F or if heart rate exceeds 110 beats per minute following one minute of rest.

5.18 Blood borne Pathogens

The OSHA Blood borne Pathogen Standard (29 CFR 1910.1030) limits occupational exposure to blood and other potentially infectious body fluids, since exposure could result in transmission of blood borne diseases. Examples of diseases that could result from exposure to blood or other body fluids include human immunodeficiency virus (HIV) and hepatitis B virus (HBV). Due to the potential for making contact with blood during field activities, the following H&S provisions shall be followed:

- Universal Precautions - Personnel shall assume that all blood and body fluids are potentially infectious.
- In general, personnel shall avoid contact with blood and body fluids, except as necessary to provide minor first aid.
- If spills of blood or body fluids are encountered, personnel shall notify the SSHO. Only trained personnel shall clean up spills. Spill areas shall be properly disinfected.
- Personnel shall wash their hands following any exposure to blood or body fluids.
- PPE, including protective gloves, must be used when handling blood or body fluids.
- Blood-contaminated waste will be segregated from other wastes and disposed as medical waste in accordance with local regulations.

A blood borne pathogen exposure control kit will be maintained on-site during the project. As necessary, personnel who are potentially exposed to blood borne pathogens will receive a follow-up (post-exposure) medical exam.

5.19 Environmental Hazards

In addition to chemical and physical hazards, there are environmental hazards that may be present. In Port Jefferson these include the possibility for encountering the following:

- Black widow spiders
- Brown recluse spiders
- Mosquitoes

If encountered, personnel shall avoid disturbing animal nesting areas and poisonous vegetation. Personnel shall keep eating and work areas free of food that would attract pests. Personnel shall also be alert to the potential for scorpion and snake bites. If a bite or dermal contact with poisonous vegetation is

sustained, personnel shall seek immediate medical attention. Personnel shall contact CDM in the event any threatening environmental hazards are encountered.

The creation of pools of stagnant water, which tends to attract mosquitoes, shall be avoided the maximum extent possible.

6.0 Personal Protective Equipment

When engineering and administrative controls are not feasible or adequate to protect personnel from the hazards associated with project activities, PPE use will be required. This section discusses the anticipated PPE requirements for the project. However, PPE requirements may be adjusted (upgraded or downgraded) in the field based on actual field conditions and/or results of air monitoring activities (refer to Section 9.0). The site-specific PPE requirements are discussed below and are summarized in Table 6-1.

6.1 Respiratory Protection

Level C respiratory protection will not initially be required. However, the Arrowhead SSHO and/or CDM health and safety representative are not restricted from requiring respiratory protection based on site conditions, including the detection of airborne VOC or dust levels that exceed the site action levels (refer to Tables 5-1 and 5-2). If respiratory protection becomes necessary, personnel will don half-face air-purifying respirators (APRs) with the appropriate filter cartridges. Respiratory protection equipment shall be NIOSH-approved, and respirator use will conform to ANSI Z88.2 and OSHA 29 CFR 1910.134 requirements. All personnel using APRs shall have successfully passed a respirator fit test within the last 12 months. Fit testing and any training related to respiratory protection for site personnel will be documented (refer to Section 13.0). Respirators shall be inspected before each use for damage, missing parts, and proper function. If respirators are deemed necessary by the SSHO and CHSO the HASP will be amended to include fit testing procedures and training certificates for the fit test personnel. Refer to Appendix D for a copy of the Arrowhead Corporate Health and Safety Plan respirator program.

6.2 Levels of Protection

Level D protection is the initial level of protection for all construction activities occurring at the site (refer to Table 6-1). It represents the minimum requirements for PPE during normal / routine working conditions. Level D PPE shall, at a minimum, consist of:

- High-visibility vests
- Shirt, long pants
- Steel-toed work boots
- Safety glasses with side-shields
- Hearing protection (as required)
- Vinyl or nitrile gloves when handling fluids
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary) – i.e. leather gloves when utilizing hand and power tools
- Hard hat

If conditions change such that Level D is considered insufficient, the initial upgrade will be Level D-Modified. For example, increased contact with contaminated soil or groundwater may prompt an upgrade to Level D-Modified to avoid potential skin exposure and clothing contamination. Activities potentially requiring Level D-Modified or Level C PPE are listed in Table 6-1. Level D-Modified and Level C PPE shall, at a minimum, consist of:

- Half-face APR with HEPA filters or OV cartridges (Level C only)
- High-visibility vests
- Long pants
- Steel-toed boots
- Safety glasses with side-shields
- Uncoated coveralls, such as Kleenguard™, with short sleeve shirt
- Vinyl or nitrile gloves
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary) - i.e. leather gloves when utilizing hand and power tools
- Hearing protection
- Hard-hat

In general, levels of PPE are subject to change or modification as site activities progress. Upgrading of PPE may occur when real-time air monitoring indicates exposures greater than action levels, or as specified by the SSHO. Levels of PPE shall not be downgraded without prior approval from the SSHO.

7.0 Site Control and Work Zones

The primary purposes of site control are to protect personnel and public from chemical and physical hazards associated with site activities and to prevent the spread of contamination to clean areas. The work areas that pose physical hazards to personnel will be regarded as regulated or restricted. If significant exposure to site contaminants within a given work area is known or suspected, the area will be designated an exclusion zone. These areas will be established in general accordance with *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH, et al. 1985).

7.1 Support Zone

The support zone will include the following facilities:

- Equipment lay-down area
- Sanitation facilities
- Portable toilet
- First-aid station
- Cool down / break area

Eating, drinking, and smoking will only be allowed in designated areas of the support zone. The location of the support zone is shown on Sheet C-01 of Arrowhead's Work Plan.

7.2 Exclusion Zones

As required, exclusion areas will be identified and marked with construction fencing, warning tape, or other appropriate barriers. At the perimeter of each exclusion zone, a single entry/exit point will be established. Upon exiting the exclusion zone, personnel will proceed to the personnel decontamination area, which will function as a contamination reduction zone (CRZ). The personnel decontamination area will serve as a station for the following:

- Donning PPE upon entry to the exclusion zone
- Doffing and disposing PPE upon exiting the exclusion zone
- Decontaminating small equipment and personnel upon exiting the exclusion zone

PPE will be removed within personnel decontamination area (CRZ), cleaned (if not disposable), or placed in plastic bags for disposal. Personnel decontamination procedures are further discussed in Section 8.0.

7.3 *Restricted Areas*

Due to the presence of physical hazards, all areas where construction activities are in progress will be considered restricted (including open trenches, the treatment building site, and well vaults). Construction areas will be clearly identified and marked as restricted with construction fencing, warning tape or other appropriate barriers placed at the boundary of each restricted area. Warning signs will also be posted at the boundary of the restricted area. Warning signs will state “Caution,” “Authorized Personnel Only”. Restricted area boundaries will be established and modified by the SSHO or Site Supervisor as construction activities progress.

7.4 *Site Entry Requirements*

Project personnel will monitor the site for entry by unauthorized personnel. Visitors will be required to sign an entry/visitor log located inside the site trailer. Visitors not directly involved in onsite project activities will not be permitted to enter restricted areas or exclusion zones without first checking with the Site Supervisor or SSHO. In order to allow an individual into a restricted area or exclusion zone, he/she must meet the following requirements:

- Documentation of training requirements (refer to Section 11.0)
- Obtain authorization from Site Supervisor or SSHO
- Attend an orientation meeting with the SSHO
- Don the appropriate PPE
- Sign the site entry log

Visitors will be escorted at all times.

8.0 Decontamination

The SSHO will establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified accordingly. This section describes the necessary procedures for personnel and equipment decontamination. In general, all personnel and equipment making contact with site contaminants must be decontaminated (or discarded, in the case of disposable PPE) prior to exiting exclusion zones or entering support areas.

8.1 Personnel Decontamination

Field personnel will generally not make direct contact with contaminated media at the site, or contact will be minimal and incidental. Accordingly, personnel decontamination will consist of using “best management” sanitation practices, including:

- Rinse / wash soiled work boots as needed
- Remove and dispose soiled gloves as sanitary waste as needed
- Wash and rinse hands and face on a regular basis
- Shower regularly
- Launder work clothing regularly
- Avoid distributing / transporting contaminated media to clean areas
- Dispose of PPE in municipal trash

Where traditional exclusion zones are established, personnel decontamination shall consist of discarding disposable PPE, cleaning re-usable PPE, and washing the hands and face. The general decontamination sequence for activities conducted at Level D-modified is as follows:

- Wash outer gloves and boots, or remove boot covers
- Rinse outer gloves and boots
- Remove outer gloves and boot covers
- Remove and rinse safety glasses/goggles and hard hat (as necessary)
- Remove coveralls
- Remove inner gloves
- Wash hands and face.

Disposable gloves and coveralls will be removed by turning inside out. Ground cloths, gloves, coveralls, will be placed into plastic trash bags and retained for disposal. If required based on a PPE upgrade, respirators shall be cleaned with potable water in the field after each use and shall be washed at the end of the day using a soap and water wash followed by disinfection. Other reusable protective equipment worn by personnel performing field activities will be rinsed with potable water after each use and will be cleaned at the end of each day in the manner described by the manufacturer. Reusable PPE items will be air-dried and properly stored.

Temporary decontamination stations may be established as project activities and needs warrant, such as inadvertent contact with contaminated groundwater.

Refer to Section 10.3 for emergency personnel decontamination procedures.

8.2 Equipment Decontamination

Decontamination of large equipment (i.e. heavy construction equipment) will follow one of two pathways if used in areas of contaminated soil:

- All equipment making contact with contaminated soil (i.e. excavator bucket) will be properly decontaminated to remove all contamination that may be adhering to the equipment surfaces before equipment is transferred from a “dirty” task to a “clean” construction task or before the piece of equipment is removed from the site.
- Decontamination will generally consist of spraying with a low volume, high pressure (or steam) washer. As needed, a “decontamination pad” will be constructed (using plastic sheeting, lumber, hay bales, etc.) to promote the collection / recovery of rinse water. The SSHO or Site Supervisor will inspect all equipment leaving the site for adequacy of decontamination. Rinse water from this process will be collected and treated on-site.
- If the equipment was used for clean construction work, where contact with saturated soils or groundwater was avoided, decontamination will generally consist of spraying with a low volume, high-pressure (or steam) washer. Rinse water will be allowed to discharge to the ground surface. This procedure is anticipated to apply to most of the heavy equipment used during the project.

Reusable sampling equipment and any other tools used for water sampling activities will be decontaminated between samples using soap (phosphate detergent) and water as follows:

- Wash and scrub with a phosphate detergent
- Tap water rinse
- Analyte-free water rinse (distilled / deionized water)
- Analyte-free water rinse
- Air dry

The rinse and wash water will be containerized for subsequent on-site treatment.

At the conclusion the field work, all equipment will be thoroughly cleaned using the methods previously described. The SSHO or Site Supervisor will inspect all equipment leaving the site for adequacy of decontamination. Heavy equipment used in areas where soil contamination does not exist will not require decontamination.

8.3 *Decontamination Equipment*

Decontamination equipment and supplies may consist of the following:

- Potable water
- De-ionized or distilled water
- Wash tubs
- Detergent, such as Alconox
- Brushes, hand sprayers
- Plastic sheeting
- 5-gallon buckets
- Garbage bags
- 55-gallon drums
- Labels or paint sticks for marking contents of containers.

9.0 Air Monitoring Plan

Ambient air monitoring using real-time, direct-reading instruments will be conducted during select construction activities to verify that personnel/public exposure to VOC's is maintained below permissible limits and to verify that administrative controls, engineering controls, and PPE are effectively preventing harmful exposures to project personnel. Respirable dust will be monitored using visual inspection.

9.1 Real-Time Air Monitoring

Direct, real-time air monitoring for VOCs will be conducted during all project activities that penetrate the ground surface, involve the disturbance of contaminated soils, or are susceptible to generating high levels of nuisance dust (refer to Table 6-1).

VOCs – Direct reading air monitoring will be performed to determine exposure to workers and the public. Air monitoring will be conducted within the general work area within and surrounding the exclusion zone, including the support zone, to assess ambient conditions. Air monitoring will also be performed within the breathing zones of personnel working in the exclusion zone (excavations) to assess individual exposures. Continuous air monitoring for VOCs will be performed for any activity occurring within exclusion zones. If field personnel experience sustained VOCs readings at concentrations exceeding site action levels (refer to Table 9-1), the SSHO will have the option of using colorimetric detector tubes to verify the airborne TCE concentrations (for comparison to PELs).

Particulates – Air monitoring for total particulate levels will be conducted daily using visual inspection to ensure that workers exposure to total dust is controlled to a minimum, with zero visible dust the goal. If the SSHO or Site Supervisor deems necessary, particulate monitoring using an aerosol monitor will be completed. Action levels for particulate monitoring are detailed in Table 9-1.

Combustible Gases and Oxygen – Air monitoring for oxygen, combustible gases, and VOCs will be conducted prior to entering excavations, trenches, and confined spaces (as necessary). Continuous monitoring during entry will also be performed.

In summary, the following are the types of air monitoring equipment that will be utilized during the project:

- **Photionization Detector with 11.7 eV lamp** – PI 101 or equivalent
- **Aerosol monitor** – MIE PDR-1000 or equivalent

- **Combustible Gas Indicator and Oxygen (CGI / O2) Meter** – MSA Watchman or equivalent

All readings will be recorded on field log sheets, inclusive of the date, time, location, and weather conditions. Reading from the PID will be compared to site action levels (refer to Table 9-1) to determine if potential unsafe conditions exist. Sustained dust levels for more than one minute shall warrant one or more of the following responses:

- All construction personnel temporarily will stop work
- Engineering controls for dust (refer to Section 5.2) will be increased until no visible dust levels are achieved
- Construction personnel will not resume work until elevated VOC or dust levels diminish
- As a contingency only, construction crews working within the exclusion zones will upgrade to Level C respiratory protection

9.2 Calibration and Maintenance

All air monitoring equipment will be factory-calibrated and maintained in accordance with the manufacturer's recommendations. Calibration/maintenance specifications from the manufacturer shall include:

- Name of equipment
- Equipment identification
- Calibration frequency
- Calibration certifications (periodic calibrations)
- Operating instructions
- Calibration/maintenance instructions
- Addresses of service centers

9.3 Record Keeping

The SSHO or his/her designee will be responsible for maintaining all air monitoring records. The following air monitoring information shall be recorded in the field logbook and/or on a real-time air monitoring log sheet (refer to form in Appendix A):

- Date, time, location, operations performed
- Meteorological data (i.e., temperature)
- Equipment identification
- Calibration information (as applicable)
- Background readings
- Monitoring results

Real-time air monitoring log sheets, and other related air monitoring data and calibration records shall be maintained, controlled, and retrievable at all times by the SSHO. These records shall be maintained in the field office files by the SSHO and eventually transferred to the permanent project files (refer to the CQCP). The calibration and monitoring log sheets applicable to the site are provided in Appendix A.

9.4 Time-Integrated Air Sampling (Optional)

Time-integrated air sampling may be conducted as directed by the CHSO based on the results of real-time air monitoring. The objective of time-integrated air sampling will be to quantify specific COCs (i.e. TCE and PCE) in comparison to PELs. If implemented, time-integrated air samples will be collected using passive dosimeters (organic vapor cassettes), such as Chem Express Personal Monitors. Samples will be collected throughout the entire work shift for calculation of TWA exposure to VOCs.

10.0 Emergency Response Plan

An emergency situation is defined as a sudden, generally unexpected occurrence demanding immediate action. Emergencies may include accidents, injuries requiring medical care, fires, explosions, spills and other significant releases hazardous substances, and extreme weather events.

10.1 Emergency Responsibilities and Authority

The Site Supervisor/SSHO will be responsible for implementing and directing emergency response procedures and determining appropriate response actions, including the decision whether or not to evacuate or take shelter. Local authorities (i.e., fire department) will decide if the emergency requires evacuation of the surrounding community. Responsibility for community evacuations will be with the local authority in charge of the emergency. The emergency response plan will be rehearsed regularly as part of the overall training program for site operations as required by OSHA part 1910.120 (l)(3)(iv).

10.2 Emergency Contacts and Notification

Telephone numbers for emergency contacts will be maintained and posted at the site. The PM, and Site Supervisor/SSHO will be notified immediately in the event of an emergency. The Site Supervisor/SSHO will immediately evaluate the incident and, if necessary, notify emergency response personnel. The **Garden City Fire Department, (516) 746-1301**, will be notified in the event of fire, significant hazardous material spill, or other emergency beyond the capabilities of project personnel. Emergency Medical Services (EMS), via 911, shall be contacted in the event of personal injury or medical emergency (beyond minor first-aid). The information provided to the emergency contact should include the nature of the incident and the exact location. Specifically, the information shall include:

- Name and telephone number of the individual reporting the incident
- Location and type of incident
- Nature of the incident (i.e., fire, explosion, spill, or release) and substances involved (if any)
- Number and nature of medical injuries
- Potential for additional risks or dangers
- Potential off-site risks or dangers
- Movement or direction of spill/vapor/smoke
- Response actions currently in progress
- Estimate of quantity of any released materials
- Status of incident
- Other pertinent information.

10.3 Medical/Personal Injury Response

Minor injuries will be treated on-site by qualified first-aid/CPR responders. In the event of moderate to severe physical injury, EMS shall be summoned. A map to the **Winthrop University Hospital (516)**

663-0333 is presented in Figure 3-1. The following procedure will be implemented in the event of an emergency:

- 1) Assess and Stabilize the Victim (Conscious or Unconscious, severity of injury, life threatening or superficial injury, body temperature) using First Aid.
- 2) Immediately notify Site Manager of incident.
- 3) Call “911”.
- 4) If practical, identify the nature of the injury and vital statistics—this will help the dispatcher identify the type of response equipment needed—i.e., man-basket for head or neck injury or EMT burn unit for burn related injury.
- 5) Describe to the dispatcher the nature and extent of the incident or injury

However, injured personnel who require medical treatment beyond minor first-aid, shall be transported to the hospital by EMS. First-aid and emergency eyewash equipment shall be available at the site. Personnel will be notified as to the locations of first-aid equipment and eyewash stations during the initial safety briefing session. The following procedures will be implemented in the event of a personal injury (other than first-aid only):

- Administer first-aid and radio the field office (Site Supervisor/SSHO) to arrange for dispatch of the EMS.
- When the situation has been stabilized, decontaminate the injured person. Do not perform decontamination if it interferes with emergency treatment, such as in a life-threatening situation.
- Move the person to the support area if there is no risk of further injury.
- Wait for emergency care, and maintain radio contact with the Site Supervisor/SSHO.

If the injury or illness occurs from exposure to a hazardous substance, rapid identification of that substance should be attempted. This information shall be provided to the medical personnel, which may include SDS for operational chemicals. In the event of a chemical exposure, the following procedures shall be followed:

- **Skin Contact.** Flush with water; remove clothing, flush skin with water; obtain medical attention.
- **Inhalation.** Remove the person from the area; administer first-aid/CPR, as needed; obtain medical attention.
- **Ingestion.** Contact the Poison Control Center [(800) 366-8888] for immediate treatment, then obtain medical attention. Inducing vomiting may cause further injury to the victim; follow instructions from the MSDS and/or Poison Control Center.
- **Eye Contact.** Flush eyes immediately with water. Corrosive materials require flushing with water for a minimum of 15 minutes. Obtain medical attention.

If the injury occurs while working in the exclusion zone emergency decontamination will involve a dry decontamination, consisting of the removal of all soil, debris, and loose material from the persons clothing and skin. A wet decontamination will only be completed if necessary. The CDM HSO and Arrowhead SSHO will discuss with EMS personnel to agree on decontamination necessary to prevent exposure of others to contaminants while meeting the immediate medical concerns.

10.4 Fire Response

In the event of a fire or explosion at the site, the following actions shall be implemented:

- Evacuate all personnel to a safe location upwind or crosswind of the incident. Contact the PM and Site Supervisor/SSHO.
- Concurrently with the above, contact the local fire department.
- If personnel are present who have had training in the use of fire extinguishers, use available fire extinguishers to extinguish fires in their incipient stages.
- Alert the local hospital of the possibility of fire victims, as appropriate.

Following the incident, details shall be documented in the field logbook or on separate incident reporting forms.

10.5 Spill Prevention and Response

The following measures shall be taken to minimize the possibility of spills/discharges:

- Site security and controls are to be maintained so that only authorized personnel have access to work areas.
- Site personnel will be advised of appropriate spill/discharge control measures.
- Containers (drums) will remain closed except when adding/dispensing product.
- Containers will be stored upright and in an orderly fashion.
- Appropriate secondary containment structures will be used for storage of fluids on-site.
- Storage containment will be examined daily.
- Small containers of chemical product will be stored inside the job box when not in use. Flammable products will be stored inside approved cabinets.

If a spill or other release of a hazardous material occurs, the Site Supervisor/SSHO will be immediately notified. An assessment will be made of the magnitude and potential impact of the release. If it is safe to do so, site personnel will attempt to locate the source of the release, prevent further release, and contain the spilled and/or affected materials as follows:

- The spill or release area will be approached from upwind (if outside).

- Hazards will be identified based on available information from witnesses or material identification documents (i.e., placards, SDS). The potential hazards will be evaluated to determine the proper personal protection levels, methods, and equipment necessary for response.
- If necessary, the spill area will be evacuated, isolated, and secured.
- The spill area will be sealed off using caution tape or other appropriate means.
- Entry to the spill area will be made by personnel with the PPE, training, methods, and equipment necessary to perform the work. Hazardous spill containment and collection will be performed as follows:
 - Contain the spill with absorbent socks, booms, granules, or construction of temporary dikes. Cover or dike floor drains, storm drains, and other conduits for off-site migration of the spilled material.
 - Control the spill at the source by plugging leaks, up-righting containers, over packing containers, or transferring contents of a leaking container.
 - Collect the spilled material with shovels and other equipment as necessary.
 - Store the spilled material in drums for further treatment or disposal.
 - Decontaminate personnel and equipment after the response is complete.

If site personnel cannot safely respond to an environmental release, evacuation of the area may be warranted. Upon arrival at the site, the Site Supervisor/SSHO will brief emergency responders of the current status and potential hazards. Following a spill incident, details shall be documented in the field logbook and on an Incident Investigation Report form (Appendix A).

10.6 Evacuation Procedures

In the event that site evacuation is required, an announcement will be made to field crews using verbal communication, cellular phones, or two-way radios. **Personnel working in the restricted area will immediately proceed to the designated safe area (selected by the SSHO at the start of the project, with concurrence from CDM) for a “head count”.**

10.7 Severe Weather Procedure

Personnel should be aware of the possibility for severe weather. Necessary precautions or response, directed by the SSHO, will be taken in the event of severe weather. Local weather broadcasts will be monitored by the Site Supervisor / SSHO when severe weather is imminent. Direct announcements will be used to alert crews of threatening weather and recommendations to take shelter. Accordingly, personnel should take refuge in a nearby building at the Site (selected by the SSHO at the start of the project, with concurrence from CDM).

In the case of lightning, work will be halted and all personnel will take shelter in the project trailer or a nearby building. Initially, work will be halted for a minimum of 30 minutes, if lightning is not observed during this period work will resume but continued observation for lightning will be maintained. If

lightning persists beyond the initial 30-minute work stoppage work will be halted until no lightning has been observed for a minimum of 30-minutes.

10.8 Emergency Equipment

At a minimum, the following emergency equipment shall be maintained at the site:

- Fire extinguishers
- First-aid kits
- Blood-borne pathogen control kit
- Emergency eyewash
- Communication devices (cellular phones, two-way radios)

This equipment will be inspected by the SSHO on a regular basis during the project to verify that they are in good condition, ready to use, and easily accessible.

10.9 HASP Rehearsal

Rehearsals of the HASP emergency procedures will be completed by review of appropriate topics at least weekly during the daily tailgate health and safety meeting. Topics will be focused towards tasks that are currently in progress.

11.0 Training Requirements

The SSHO is responsible for informing all site personnel and all visitors of the contents of this SSHP and ensuring that each person accepts the provisions of the SSHP (by signing the SSHP Acknowledgment Form in Appendix A) prior to working on the site. Documentation of training certification(s) for project personnel will be reviewed by the SSHO, filed on-site, and submitted to CDM (upon request).

11.1 HAZWOPER Training

Full-time construction personnel working on the following tasks will be required to meet the HAZWOPER training requirements per 29 CFR 1926.65 and 29 CFR 1910.120, including an initial 40-hour training course and an 8-hour refresher class within the past 12 months:

- Demolition and installation of process equipment
- On-site water treatment operations during construction (prove-out)
- Submersible well pump installation
- O&M

Project personnel shall certify that they have received HAZWOPER training by completing the Training/Medical Acknowledgment Form in Appendix A.

Personnel working on all other tasks (i.e. Yard piping installation, electrical installation, land surveying, etc.) are not required to possess HAZWOPER training.

11.2 Daily Tailgate Safety Meetings

The Site Supervisor/SSHO (or designee) shall conduct a safety meeting at the beginning of each shift. The topics discussed at this daily “tailgate” safety meeting shall include:

- H&S considerations for the day’s activities
- Hazard assessments
- Engineering controls to be implemented
- Required PPE
- H&S supply inventory
- Problems encountered and lesson’s learned
- Areas/activities requiring special warning or caution
- Related safety topics

Attendance records and meeting notes will be recorded on the Daily Tailgate Safety Meeting Log (Appendix A). Daily Tailgate Safety Meeting Log will be maintained with the project files and will

submitted to CDM as part of the Daily Quality Control Report (refer to the Contractor Quality Control Plan).

11.3 Site-Specific Orientation Meetings

All personnel, including subcontractors, working at the site shall attend a site-specific orientation covering the following topics:

- Purpose and review of the SSHP
- Names and responsibilities of personnel responsible for site safety
- The provisions for medical care and facilities and the names of CPR and first-aid trained personnel assigned to the project
- H&S hazards on-site and the means to control/eliminate those hazards
- Procedures for reporting and correcting unsafe conditions or practices
- Responsibilities for reporting all accidents and illnesses
- PPE requirements, use, and care
- Location of safety equipment (i.e., fire extinguishers, first-aid kits, eye wash stations)
- Standard operating procedures, safety rules, and safe work practices for the project
- Work zones and site control measures
- Hazard Communication Program (includes discussion of applicable SDS)
- Fire protection and prevention
- Housekeeping
- Other pertinent aspects of project-specific hazard assessments

The content of the training will be derived from information contained within this SSHP. CDM will be notified prior to the site-specific orientation session.

11.4 Hazard Communication

All personnel performing field activities will receive basic hazard communication and right-to-know training, including a review of Arrowhead's Hazard Communication Program, applicable SDS, container labeling requirements, chemical hazard warnings, and general chemical health hazards. Personnel shall be trained on the hazards of operational chemicals by reviewing SDS. SDS for additional materials brought on-site will be reviewed with personnel prior to the use. Training shall be documented on the Hazard Communication Training and Right-to-Know Training Form in Appendix A.

11.5 First-Aid/CPR

At least one member of Arrowhead's on-site staff will be trained and certified in both American Red Cross first-aid and CPR. The certification and recertification requirements for first-aid (three years) and

CPR (one year) are applicable. First-aid and CPR training/certification must be made by a reputable provider, such as the American Red Cross or American Heart Association.

11.6 Additional Training, Certification, and Licenses

In addition to the training and certification discussed previously, commercial drivers must meet applicable certification and licensing requirements as mandated by the DOT. Truck drivers must possess a valid commercial driver's license.

12.0 Medical Surveillance Requirements

Medical surveillance requirements will apply to personnel covered under HAZWOPER requirements, as specified in Section 1.3. Arrowhead and subcontractors will utilize the services of a Board-Certified Occupational Medicine physician for the medical surveillance requirements of this project.

12.1 Medical Examination

All affected personnel will have successfully completed a pre-placement or periodic/updated physical examination that complies with HAZWOPER (29 CFR 1926.65 and 29 CFR 1910.120). Pre-placement (baseline) medical examinations shall consist of a standard battery of tests, including, but not limited to:

- Medical and occupational history questionnaire
- Physical examination
- Chest X-ray (no more frequently than every four years)
- Blood pressure
- Complete Blood Count
- Blood urea nitrogen and serum creatine
- Sequential Multiple Analyzer Computer Profile (SMAC 24)
- Pulmonary function test
- Audiogram
- Electrocardiogram (EKG) for employees over 35 years old or when other complications indicate the necessity
- Stress test (as directed by the occupational physician based on EKG/pulmonary function testing)
- Visual acuity
- Urinalysis

The following information shall be provided to the occupational physician:

- Copy of 29 CFR 1926.65 and 29 CFR 1910.120
- Description of employee's duties
- Site contaminant information
- Description of the PPE to be used and anticipated or measured exposure
- Information from previous medical exams
- Copy of Section 5.0 of the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH et al., 1985)
- Information required by 29 CFR 1910.134.

The medical surveillance provided to the employee includes a written opinion by the medical examiner of the employee's ability to use the necessary respiratory protective equipment. Any employee found to

have a medical condition, which could directly or indirectly be aggravated by exposure to any chemical substance present at the site, or by the use of respiratory equipment, will not be employed for the project. A copy of the medical examination shall be provided at the employee's request. The employee will be informed of any medical conditions that would result in work restriction or that would prevent him/her from working at hazardous waste sites.

Site personnel may be required to receive an annual update exam in accordance with 29 CFR 1926.65(f)(2) and 29 CFR 1910.120(f)(2). The results of these exams are compared to previous results and the baseline physical to determine if any medical effects due to exposure have occurred. Appropriate actions shall be taken as recommended by the physician should the results indicate an exposure; otherwise, employees are cleared for continued work.

Periodically, the need arises to conduct medical examinations at times other than those previously discussed. These times include reassignment in accordance with 29 CFR 1910.120 (f)(3)(i)(C) and 29 CFR 1926.65 (f)(3)(i)(C), if an employee develops signs or symptoms of illness relating to work place exposure, if the physician determines examinations need to be conducted more often than once a year, and whenever an employee sustains a lost time injury or develops a lost time illness.

12.2 Subcontractor Requirements

Subcontractor personnel that are performing work activities involving contact with contaminated material shall certify that their employees have successfully completed a physical examination by a qualified physician on the Training/Medical Acknowledgment Form in Appendix A. The physical examinations shall meet the requirements of 29 CFR 1926.65 and 29 CFR 1910.120.

12.3 Medical Records

Medical and personal exposure monitoring records will be maintained according to the requirements of 29 CFR 1926.65 and 29 CFR 1910.120 and will be retained for a minimum of 30 years. The confidentiality of employee medical records shall be maintained. The written medical opinion from the occupational physician is kept in site files.

12.4 Medical Restrictions

When a medical care provider identifies a need to restrict work activity, the terms of the restriction will be discussed by the employee and the SSHO. Every attempt will be made to keep the employee working, while not violating the terms of the medical restriction.

13.0 Record Keeping and Reporting

Proper record keeping and data management are essential in the implementation of this SSHP. The forms associated with the record keeping and data management requirements shall be completed in an accurate, timely fashion and appropriately filed. The proper completion of H&S forms is the responsibility of the Site Supervisor/SSHO. Subcontractors will also be responsible for keeping a copy of the forms pertaining to their activities. A copy of all pertinent H&S forms and logs for the project are provided in Appendix A.

13.1 Daily Safety Forms and Logs

The following forms and logs (Appendix A) will be completed daily as applicable:

- SSHP Acknowledgment Form
- SSHP Amendment Form
- Site Entry Log
- Daily Tailgate Safety Meeting Log
- Hazard Communication and Right-to-Know Training Form
- Utility Clearance Form
- Real-Time Air Monitoring Log (PID)

These forms will be attached to the Daily Quality Control Report (DQCR)

13.2 Daily Safety Reporting

The SSHO will record H&S activities and data, not otherwise captured in daily logs or forms (refer to Section 13.1) in a field log book. The SSHO will summarize health and safety related matters for each day's work in a section of the DQCR.

13.3 Safety Inspections

The SSHO will inspect the site daily and identify areas of concern or ideas for safety improvement. The Site Supervisor will also inspect site conditions and activities daily to identify changing conditions or potential hazards. Identified safety and occupational health deficiencies and suggested corrective measures will be brought to the attention of the Site Supervisor, PM, and/or SSHO. Corrective actions will be documented as described in the CQCP, including the corrective action taken/proposed, responsible person, and the date the corrective action is to be completed. Follow-up inspections will be performed to verify that corrective actions or measures have been implemented. Significant findings during safety inspections will be included in the DQCR. Applicable inspection checklists are provided in Appendix A, including:

- Daily Safety Equipment Daily Inspection Checklist
- Heavy Equipment Initial Inspection Checklist
- Heavy Equipment Daily Inspection Checklist,

- Trench/Excavation Inspection Checklist

13.4 Accident Investigation and Reporting

Project personnel are required to immediately report all near misses, injuries, illnesses, and accidents to the Site Supervisor, PM and/or SSHO. The SSHO shall immediately arrange appropriate medical care as required. Once medical care for the injured personnel has been assured, the SSHO shall complete and submit the appropriate reports within 24 hours. The reports that may be applicable include:

- Employee Injury Report
- Vehicle Accident Report
- General Liability, Property Damage, and Loss Report
- Accident Investigation Report

All lost time injuries and property damage accidents (excluding on-the-road accidents) exceeding \$2,000 will be reported to CDM within 24 hours of the incident/accident. An accident with the consequences of a fatal injury, three or more persons admitted to a hospital, or property damage greater than \$1,000 will be reported immediately to CDM.

All near misses, injuries, illnesses, and accidents shall be immediately investigated by on-site management personnel. The Site Supervisor/SSHO will investigate the conditions contributing to the accident. They will document how the accident occurred and identify unsafe acts or conditions that occurred or existed at the time of the accident. Corrective actions will be determined and implemented to prevent the recurrence of the accident, and responsibility for implementation of corrective actions will be assigned. An Incident Investigation Report (Appendix A) shall be submitted to CDM within two working days of the incident/accident. The report shall specify:

- Company name
- Name of person reporting
- Date and time of incident/accident
- Location of incident/accident
- Summary of incident/accident giving pertinent details, including the field activity in progress at the time of the incident/accident
- Cause of the incident/accident
- Casualties
- Details of chemical hazards or contamination
- Estimated property damage, if applicable
- Nature of damage, effect on schedule
- Action taken to ensure safety/security

The final report and required forms will be submitted within five days of the incident to CDM. In the event that an accident results in an employee being sent to a doctor, a release will be obtained on the date of treatment indicating one of the following conditions:

- Employee not fit for duty
- Employee fit for light duty
- Employee fit for duty.

A copy of this release shall accompany the accident report.

14.0 References

National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, U.S. Coast Guard, and U.S. Environmental Protection Agency (USACE et al.), 1985
Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH Publication No. 85-115, October 1985.

Title 29 Code of Federal Regulations (CFR) Part 1910, *Safety and Health Regulations for General Industry*.

Title 29 Code of Federal Regulations (CFR) Part 1926, *Safety and Health Regulations for Construction*.

U.S. Army Corps of Engineers (USACE), *Safety & Health Requirements Manual*, EM 385-1-1, 3 September 1996.

U.S. Army Corps of Engineers, 1994, *Safety and Occupational Health Document Requirements for Hazardous, Toxic and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OWE) Activities*, Appendix A, ER 385-1-92.

Table 2-1
Safety and Health Responsibilities

Name	Telephone Number(s)	S&H Responsibility
Mr. Scott Siegwald, CIH (Arrowhead Contracting, Inc.)	(816) 912-2243 office (913) 461-3804 cell	Corporate Health and Safety Officer (CHSO)
Mr. Greg Wallace (Arrowhead Contracting, Inc.)	(913) 814-9994 office (913) 461-3828 cell	Program Manager
Mr. Doug Ronk (Arrowhead Contracting, Inc.)	(913) 814-9994 office (913) 461-3805 cell	Project Manager
Mr. Joe Cotter (Arrowhead Contracting, Inc.)	(913) 814-9994 office (913) 961-5257 cell	Site Supervisor
Mr. Clayton Nystrom (Arrowhead Contracting, Inc.)	(254) 644-2822 cell	Site Safety and Health Officer / Quality Control Officer

Table 4-1
Summary of Potential Site Hazards

Hazard	Description
Chemical exposure (site contaminants)	<p>Potential for exposure to chlorinated VOCs present in groundwater and soil. Exposure potential is low to negligible during shallow excavations and non-intrusive, above-grade construction activities. Moderate to high potential for exposure to VOCs during activities that penetrate below the ground surface and/or involve the handling of contaminated groundwater (i.e. water sampling). Primary routes of entry include inhalation and dermal contact.</p> <p>Inhalation: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and air monitoring.</p> <p>Dermal: Contact with contaminated soil. This route of exposure is minimized through proper use of PPE.</p> <p>Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).</p>
Chemical exposure (operational chemicals)	Potential for exposure to operational chemicals (including fuels and lubricants) during use and storage. Primary routes of entry include inhalation, ingestion, and dermal contact.
Dust	Potential for exposure to COCs during activities that generate COC-laden dust. Potential for inhaling nuisance dust during field activities, including excavation work, miscellaneous construction work, soil load-out, and site restoration.
Noise	High noise levels anticipated during activities involving the operations heavy construction equipment, including drilling, trenching, building construction, backfilling, and site restoration.
Eye injury	<p>Hazards to the eye include the potential for:</p> <ul style="list-style-type: none"> • Projectiles (chips, sparks, and other debris) from construction activities. • Emission of dust, fumes, and exhaust gases. • Liquid splashes from the use of operational chemicals. • Heat and extreme light/glare from welding and cutting.
Slips, trips, falls	<p>Potential for slips, trips, and falls from general site hazards, including:</p> <ul style="list-style-type: none"> • Slippery surfaces • Obstruction in walkways (i.e. power cords, hoses, small tools) • Uneven surfaces • Poor lighting • Use of ladders
Fire	Potential for fire from the use and storage of flammable liquids and gases, hot work activities (welding and cutting), and generation of sparks.
Operation of small equipment and power tools	<p>Potential for the following hazards associated with the operation of small equipment and tools:</p> <ul style="list-style-type: none"> • Contact with the point-of-operation • Impact from projectiles during use • Damaged or faulty equipment/tools • Accidental activation

Hazard	Description
	<ul style="list-style-type: none"> Excessive vibrations Awkward posture during use
Operation of heavy equipment	<p>Major project hazard, due to the operation of numerous pieces of equipment on-site. Potential for hazards from the following conditions:</p> <ul style="list-style-type: none"> Contact with moving parts of equipment (i.e. belts, chains, hoist) Danger zone created by swing radius of equipment Maneuvering equipment within/around obstructions, tight spaces, and other equipment Moving equipment near workers, including the “crushing zone” created when workers are positioned between equipment and fixed/stationary object Operating equipment near overhead power lines Concrete saw operations
Electrical	<p>Potential for electrical shock and fires from the following:</p> <ul style="list-style-type: none"> Contact with energized appurtenances at the site Improper grounding Work near overhead and below-ground power and communication lines
Hazardous energy	<p>Potential for the unexpected release of hazardous energy, such as:</p> <ul style="list-style-type: none"> Breaching live utility lines during intrusive activities. Unexpected startup of equipment during maintenance and/or change out of tooling. Hazards associated with pressure vessels.
Intrusive activities	Potential for inadvertently breaching underground utility lines during intrusive work (drilling, trenching, etc.).
Excavation hazards	Hazards associated with excavation work, including sidewall collapse, trip / fall hazards, and water accumulation.
Material handling	<p>Potential hazards with regards to lifting and handling of materials, including:</p> <ul style="list-style-type: none"> Back injury from improper lifting technique Contact with sharp or jagged edges (i.e. saw blades, piping) Dropping materials that are slippery from water, oil, or grease
Contact with hot items	Potential for burns due to contact with hot equipment (i.e. exhaust pipes, steam sprayer, and generators).
Operation of motor vehicles	Hazards associated with the operation of motor vehicles, including vehicle accidents, injury to pedestrians, damage to property, and lost loads during transport.
Heat and cold stress	Potential heat-related illnesses from working at high temperatures in a tropical environment.
Bloodborne pathogens	Potential for exposure to blood.
Environmental hazards	Potential for encountering poisonous plants, insects, snakes, spiders, etc.

Table 6-1
Levels of Protection and Air Monitoring Parameters

Field Activity	Initial Level of Protection (PPE)*	Upgrade Level of Protection (PPE)	Special Requirements	Air Monitoring Parameters
Trenching and backfill	D	Level D - Modified	Hearing Protection**	Dust, VOCs
Yard piping installation	D	Level C	Dermal Protection	VOCs
On-site GW treatment	D	Level C	Dermal Protection Hearing Protection**	VOCs
Treatment Building construction	D	Level D - Modified	Hearing Protection**	N/A
Site restoration	D	Level D - Modified	Hearing Protection**	Dust
Project administration	D	Level D - Modified	Hearing Protection**	N/A
Mobilization / demobilization	D	Level D - Modified	Hearing Protection**	N/A
Personnel travel to/from site	D	Level D - Modified	Hearing Protection**	N/A
Construction oversight	D	Level D - Modified	Hearing Protection**	N/A
Equipment cleaning and maintenance	D Mod. D (spray washer, as necessary)	Level D - Modified	N/A	N/A

* Level D is the minimum level of protection for construction activities. Upgrade level is Modified D. **If Level C respiratory protection required for work refer to Section 6.2 for additional details.**

** As necessary, based on activity or noise levels (refer to Section 5.3).

Table 9-1
Air Monitoring Action Levels

Parameter	Equipment	Frequency	PEL/TLV*	Action Level (Upgrade)	Action Level (Stop Work**)
Volatile Organics	Photoionization Detector	Conducted within the general work area within and surrounding the exclusion zone, including the support zone, to assess ambient conditions. Conducted within the breathing zones of personnel working in the exclusion zone (excavations) to assess individual exposures. Continuous air monitoring for any activity occurring within the limits of intrusive activities.	TCE: 50 ppm PCE: 25 ppm 1,2-DCE: 200 ppm 1,1-DCE: 1 ppm	15 ppm (in the absence of 1,1-DCE) 1 ppm when 1,1-DCE is detected	25 ppm (in the absence of 1,1-DCE) 1 ppm when 1,1-DCE is detected
	Passive Dosimeters (Organic Vapor Cassettes)	Based on results of real-time air monitoring, and periodically during construction. Conducted using Chem Express Personal Monitors, or equivalent.			
	Colorimetric detector tubes (Sensidyne 132SC for 1,1-DCE)	Conducted within the general work area within and surrounding the exclusion zone, including the support zone, to assess ambient conditions. Conducted within the breathing zones of personnel working in the exclusion zone (excavations) to assess individual exposures. Continuous air monitoring for any activity occurring within the limits of intrusive activities.			

Parameter	Equipment	Frequency	PEL/TLV*	Action Level (Upgrade)	Action Level (Stop Work**)
Nuisance / Total Dust	Visual Inspection	Conducted within the general work area within and surrounding the exclusion zone, including the support zone, to assess ambient conditions. Visual inspection to maintain zero visible dust. If deemed necessary by the SSHO or the Site Supervisor monitoring by aerosol monitor will be completed (see below).	NA	NA	NA
	Aerosol Monitor	Conducted within the general work area within and surrounding the exclusion zone, including the support zone, to assess ambient conditions. Conducted within the breathing zones of personnel working in the exclusion zone (excavations) to assess individual exposures.	Total Dust 15 mg/m ³ (PEL) 10 mg/m ³ (TLV)	> 5 mg/m ³ (sustained)	> 10 mg/m ³ (sustained)
Flammable/ Combustible Gases	Combustible Gas Indicator	Continuous monitoring during personnel entry into excavation. Also, prior to entry into excavations.	N/A	N/A	> 10% LEL
Oxygen	Oxygen Meter	Continuous monitoring during personnel entry into excavation. Also, prior to entry into excavations.	N/A	N/A	<19.5%
Noise	Sound Level Meter	Conduct at SSHO discretion.	90 dB	85 dB	N/A

* 8-hour time-weighted average (TWA)

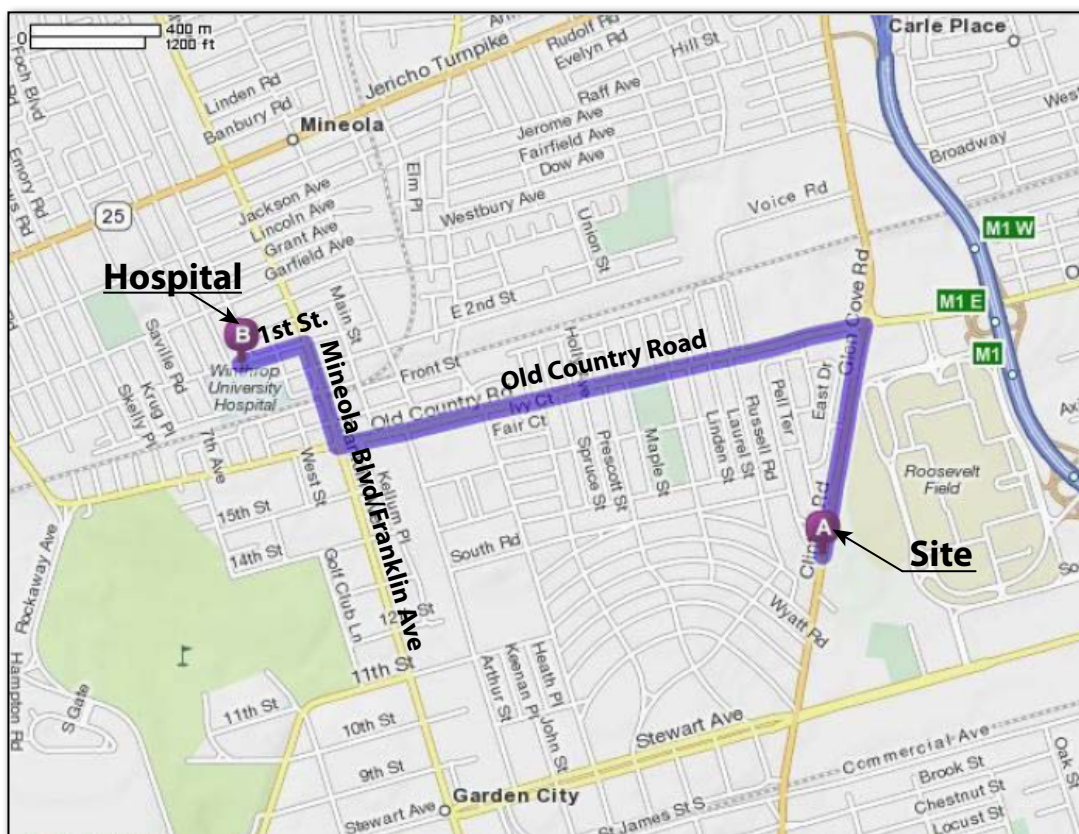
** The “stop work” level represents extreme or unusual/unexpected conditions. If the levels are sustained, the health and safety of onsite personnel and the public could be significantly compromised. Work shall be stopped so that the source of the elevated levels can be evaluated and controlled.

*** Sustained levels in the breathing zone for 5 minutes

Table 10-1
Emergency Response Contacts and Telephone Numbers

Contact	Telephone Number
Garden City Fire Department	(516) 746-1301 – non emergency (516) 746-2800 – emergency 911
Village of Garden City Police Department	911
Nassau County Health Services	(631) 853-3000
EMS, Paramedics	911
Nearest Hospital (Winthrop University Hospital) Address: 259 1 st Street Minneola, New York 11501	(516) 663-0333
CHEMTREC	(800) 424-9300
Poison Control	(800) 366-8888

New York / Long Island One-Call Service, 1-800-272-4480



Hospital Address

Winthrop University Hospital
259 1st Street
Mineola, New York 11501
(516) 663-0333

Travel estimate: 2.1 miles - approx. 7 minutes

Old Roosevelt Field Superfund Site
Garden City, New York

Figure 3-1
Hospital Route Map

Arrowhead Contracting, Inc.

Date: SEP 2010

Project No.: 10-110

Drawn by: mpd



Appendix A
Health and Safety Forms



Project Number: 10-110

[illegible]



SSHP AMENDMENT FORM

Amendment Number: _____

Date Effective: _____

Date: _____

Client: CDM Federal Programs.

Location: Old Roosevelt Field Superfund Site

Job No.: 10-110

Type of amendment:

Change of text in SSHP

Addition of form

Addition of new activity and hazard analysis

Deletion of form

Other:

Details of amendment (attach appropriate document/documentation):

Approved by: _____
Project Manager

Date: _____

Approved by: _____
Program CIH

Date: _____

DAILY TAILGATE SAFETY MEETING LOG



TRAINING/MEDICAL ACKNOWLEDGMENT FORM

By signing this certificate, you are acknowledging that you have completed the following formal training courses or medical examinations in accordance with OSHA requirements:

Training Course	Initial (next to applicable course)
24- Hour	_____
40 -Hour	_____
8- Hour Refresher	_____
8 -Hour Supervisor	_____

Site-specific Training: I have been provided and have completed the site-specific training. The Site Safety and Health Officer conducted the training.

Employee/Visitor Initials

Respiratory Protection: I have been trained in the proper work procedures and use and limitations of the respirator(s) I will potentially wear. I have been trained in and will abide by the facial hair policy.

Employee/Visitor Initials

Respirator Fit-test Training: I have been trained in the proper selection, fit, use, care, cleaning, and maintenance, and storage of the respirator(s) that I will potentially wear. I have been fit-tested and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time.

Employee/Visitor Initials

Medical Examination: I have had a medical examination per HAZWOPER requirements within the last twelve months; or I have previously had a medical examination per HAZWOPER requirements but not within the past 12 months as I am covered under OSHA 29 CFR 1910.12(f)(2). The examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. The Site Safety and Health Officer evaluated the medical certification provided by the physician and signed the appropriate blank below. The physician determined that there:

Were no limitations to performing the required work tasks:

Employee/Visitor Initials

Were identified physical limitations to performing the required work tasks:

Employee/Visitor Initials

Documentation of all applicable training required by the HASP and this form must be provided prior to beginning work.

Employee/Visitor Signature _____ Date _____

Employee/Visitor Printed Name _____

Site Safety and Health Officer Signature _____ Date _____



HAZARD COMMUNICATION AND RIGHT-TO-KNOW TRAINING FORM

Project Name: Remedial Construction Activities, Old Roosevelt Field Superfund Site
Project Number: 10-110

INITIAL:

1. I have been informed about the Hazard Communication Program, Material Safety Data Sheets (MSDS), their use and location, and the procedures to obtain copies.
2. I have been informed that some of my work may involve exposure to toxic substances, the hazards of which will be reviewed with me in daily safety meetings or site-specific training.
3. I have been informed about the right of employees to have access to relevant exposure and medical records, and the procedures for requesting access.
4. I understand that the company must act upon a request in a reasonable amount of time so as to avoid interruption of normal work operations.
5. I have been provided access to the applicable regulations governing hazard communication, and access to employee exposure and medical records.

PRINT NAME: _____

SIGNATURE: _____

DATE: _____



HEAVY EQUIPMENT INITIAL INSPECTION CHECKLIST

Project Name: Remedial Construction Activities, Old Roosevelt Field Superfund Site	Project Number: 10-110	Client: CDM Federal Programs
Project:	Contractor: Arrowhead Contracting, Inc.	Contract No.: Subcontract No. 3320-023-001-CN-S
Type and Make of Equipment	Model	Serial No.

CHECKLIST	Yes	No	N/A
1. Are adequate and serviceable fire extinguishers provided? (09.E.01 through 09.E.03)			
2. Are all wire rope cables in good condition? (15.B.01 and 15.B.02)			
3. Are wire rope, sockets, splices, thimbles, and clips adequate and properly applied? (15.B.03 through 15.B.08)			
4. Are hooks, safety nooks, shackles, rings, etc., in good condition? (?)			
5. Are necessary platforms, foot-walks, etc., provided? (22.A.01 and 22.A.02)			
6. Are access steps, platforms, etc., provided with non-slip surfaces? (21.A.13)			
7. Is operator protected against the elements, falling or flying objects, swinging loads, and similar hazards? (16.B.10, 16.B.11, and 21.A.11)			
8. Are all glasses in operator's compartment safety glass and in good repair? (16.B.10 and 18.A.07)			
9. Is suitable access provided at lubrication points? (16.B.13)			
10. Do all modifications, extensions, replacement parts, and/or repairs to equipment maintain the same factor of safety as original designed equipment? (16.A.18)			
11. Are drums for load lines equipped with at least one positive holding device, applied directly to the motor shaft or some part of the train gear? (?)			
12. Is there sufficient cable to allow three full wraps of cable on drums at all working positions? (16.C.10)			
13. Are adequate headlights, taillights, and turn signals provided and are they in proper operating condition (16.A.07 and 18.A.02 through 18.A.04)			
14. Are all approved brakes on wheeled equipment and in good operating condition? (16.A.07, 18.A.02, and 18.A.05)			
15. Do windshields have wipers in proper operating condition? (16.A.07, 18.A.02, and 18.A.06)			

CHECKLIST	Yes	No	N/A
16. Are rear view mirrors provided? (18.A.02 and 18.A.06)			
17. Are operating levers equipped with latch and other devices to prevent accidental starting? (18.A.10)			
18. Is engine equipped with power-operated starting device in operative condition? (18.A.06)			
19. Do all pressure vessels have valid inspection certificates? (20.A.03)			
20. Are reverse signal alarms on equipment? (16.B.01)			
21. Are belts, gears, shafts, electrical contacts, etc., adequately guarded? (16.B.03)			
22. Are all hot pipes and surfaces suitably guarded? (16.B.03)			
23. Are fuel tanks located so that spills or overflows will not come in contact with engine or exhaust? (16.B.04)			
24. Are exhausts and discharges so directed as not to endanger workmen or obstruct view of operator? (16.B.05)			
25. Are guards in place on equipment with drop type skip pans? (16.B.03)			
26. Are adequate seats provided for all riders? (16.A.07 and 18.C.01)			
27. Are tires in serviceable condition? Are testing/inspections documented? (18.A.02)			
28. Are steering linkage and tie rod in good operating condition? Are testing/inspections documented? (18.A.02)			
29. Are dump bodies provided with holding device or other suitable device for locking body in raised position? (18.A.10)			
30. Are tailgate dumping devices so arranged that operator will be in the clear while dumping loads? (18.A.10)			
31. Are trip handles provided on tailgates to facilitate handling? (18.A.10)			
32. Is the air hose free from leaks or defects? (? 20.B.03)			
33. Are safety lashing for quick make-up type connections provided? (20.A.16)			
34. Is an acceptable spark arrestor installed and working? (?)			
35. Do heating devices comply with references? (?)			
36. Does welding equipment comply with code requirements? (10.A.10 and 10.E.01)			
37. Is equipment adequately grounded? (10.E.04 and 10.E.07)			
38. Do electrical components comply with code? (10.E.01)			
39. Are required pressure, temperature, or relief gages and valves installed and operable? (20.A.10 through 20.A.13 and 20.B.02)			
40. Are approved seat belts and roll-over protection provided? (16.B.08, 16.B.12, and 18.B.02)			
41. Is recommended preventive maintenance being followed? (16.A.08 and 18.A.02)			

CHECKLIST	Yes	No	N/A
42. Do helicopter cranes meet construction requirements (16.J.01)			
43. Does hydraulic equipment meet special safety conditions (? 11.H.08, 11.H.09, and 13.A.09)			
44. Is concrete equipment fitted with adequate safety devices? (27.A.04)			
45. Are elevating and rotating work platforms in conformance with ANSI A92.2? (22.K.01)			
46. Do conveyors, cableways, and related equipment conform to ANSI 320.01? (?)			
47. Are pile drivers equipped with all appropriate safety devices? (16.L)			
48. Do material hoists conform to ANSI A10.5? (16.K.01)			
49. Do passenger elevators conform to ANSI A10.4? Do temporary hoists conform to ANSI A10.22: (21.H)			
50. Do hand and power tools comply with applicable ANSI standards (13.A through 13.G)			
51. Is high voltage sign posted? (?)			
52. Is equipment fitted with positive stops for rotation when near power lines? (11.E and 16.D.06)			
53. Is there any visible evidence of damage to boom? (16.C.12 and Appendix H)			
54. Is the boom position indicator operating and visible to operator? (16.D.01 and 16.D.04)			
55. Have all operators had a current physical examination? (1.C and 16.C.04)			
56. Is braking equipment capable of effectively braking, lowering, and safely holding a load of at least the full rated load as required? (?)			
Remarks:			
<p>Certification: I hereby certify that this item of equipment is in good operating condition and that it meets all above requirements except as noted in the remarks.</p> <div style="display: flex; justify-content: space-between;"> <div> <p>_____ Signature of Competent Mechanic</p> <p>_____ Signature of Superintendent/Quality Control Engineer</p> </div> <div> <p>_____ Date</p> <p>_____ Date</p> </div> </div>			



HEAVY EQUIPMENT DAILY INSPECTION CHECKLIST

Project Name: Remedial Construction Activities, Old Roosevelt Field Superfund Site	Project Number: 10-110	Client: CDM Federal Programs
Project:	Contractor: Arrowhead Contracting, Inc.	Contract No.: Subcontract No. 3320-023-001-CN-S
Equipment Description:	Model No.(s):	Serial No.(s):

CHECKLIST	OK	Not OK	N/A
1. Fuel			
2. Lubrication, engine oil			
3. Brakes			
4. Tires, tracks			
5. Air systems			
6. Horn			
7. Safety guards			
8. Mirrors			
9. Steering mechanism			
10. Cooling water			
11. Operation controls			
12. Lights and reflectors			
13. Windshield wipers, defroster			
14. Backup alarm			
15. Fire extinguisher			
16. Seat belts			
17. Filters (air, oil, fuel, hydraulic)			
18. Lift arm and bucket			
19. Grab handles			
20. Steps (tread, no slip hazards)			
21. Parking brake			
22. General condition			

Remarks:

Certification

Signature of Certified Operator

Company

Date



SAFETY EQUIPMENT DAILY INSPECTION CHECKLIST

Project Name: Remedial Construction Activities, Old Roosevelt Field Superfund Site	Project Number: 10-110	Client: CDM Federal Programs.
Project:	Contractor: Arrowhead Contracting, Inc.	Contract No.: Subcontract No. 3320-023-001-CN-S

CHECKLIST	Yes	No	N/A
1. Are adequate and serviceable fire extinguishers provided?			
2. Are fire extinguishers present at assigned locations?			
3. Is access to each fire extinguisher clear of obstructions?			
4. Are fire extinguishers fully charged; are locking pins in place?			
5. Are eye wash stations present at assigned locations?			
6. Are eye wash stations filled with water and in sanitary condition?			
7. Is access to each eye wash station clear of obstructions?			
8. Are first aid kits present on site?			
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?			
10. Are emergency spill supplies/kits available on site?			
11. Have air monitoring instruments been properly calibrated?			
12. Is the required PPE available on site?			
13. Has the PPE been inspected for defects or damage?			
14. Are flammable chemicals (not in use) stored in an approved cabinet?			
15. Are Material Safety Data Sheets available on site for operational chemicals?			
16. Is a bloodborne pathogens exposure kit available on site?			
17. Is cold, potable water available to employees?			
18. Are ear plugs or muffs available to personnel?			

Remarks:

Certification

Signature of Site Safety & Health Officer

Date



REAL TIME AEROSOL MONITORING LOG

Project Name Remedial Construction Activities, Old Roosevelt Field Superfund Site
Date _____

Project No.: 10-110

Sampled By	Instrument Type (Mfg./Model/Serial No.)	Battery Charged (Y/N)	Zeroed (Y/N)	Sample Time		Sample Readings (mg/m ³)			Comments
				Start	Finish	TWA	Shift Average	Direct	

General Weather Conditions _____



Project Name Remedial Construction Activities

Location Old Roosevelt Field Superfund Site Project No. 10-110

[illegible]

INTRUSIVE ACTIVITIES PERMIT**Permit Number**

Project Name: _____

Project Number: _____

Clearance is permitted for intrusive activity at: _____

The attached map indicates the limits of the permitted intrusive activity. The area __ has __ has not been staked or clearly marked.

Utilities Locate Service Reference Number: _____

Limits of Work Permitted**Description of permitted work:****Specific location of permitted work:****Precautions or comments:****Date Clearance Permitted:****Date Clearance Terminated:****Request Initiated By:****Phone No.****Organization**

Permission to proceed with intrusive activity granted:

Field Supervisor/Project Manager_____
Date

Permission to proceed with intrusive activity granted:

Site Safety and Health Officer_____
Date

I agree to perform work within the limits of this permit:

Supervisor/Foreman/Contractor_____
Date



UTILITY CLEARANCE FORM

Project Name: Remedial Construction Activities, Old Roosevelt Field Superfund Site

Project No. 10-110

Date: _____

Location of Excavation: _____

The undersigned personnel have *staked* or *otherwise located* existing underground utilities in order to proceed with excavation required. The Contractor shall repair any damage to the existing utilities at no cost to the Government.

Signature	Date	Utility Company Name	Utility Type
			Electric
			Water and Sewer
			Telephone
			Fiber Optic
			Cable
			Natural Gas

I certify that the location of excavation has been evaluated for clearance of underground utilities as well as 10-foot clearance from overhead power lines.

Signature of Contractor Representative

Date



Project Name: Remedial Construction Activities, Old Roosevelt Field Superfund Site
Project Number: 10-110

INCIDENT INVESTIGATION REPORT

*** MUST BE COMPLETED WITHIN 72 HOURS ***

Investigation Date: _____

Date of Incident: _____

Employee Name: _____

Supervisor Name: _____

Location of Incident: _____

- **Incident Classification**
 - Injury • First Aid • Vehicle • Chargeable • DOT • DOT Vehicle
 - OSHA Recordable • Non-Chargeable • DOT Reportable
 - Lost Workday
 - Restricted Workday • Near Miss • General Liability •

- **Description (Provide facts, describe how incident occurred, provide diagram (on back) or photos)**

- **Analysis 1 (What unsafe acts or conditions contributed to the incident?)**

- **Analysis 2 (What systematic or management deficiencies contributed to incident?)**

- **Corrective Action(s) (List corrective action items, responsible person, scheduled completion date)**

- **Witnesses (Attach statements or indicate why unavailable)**

Investigated By _____ **Print Name:** _____ **Signature:** _____ **Date:** _____

Project Manager _____ **Print Name:** _____ **Signature:** _____ **Date:** _____

(Attach Additional Pages if Needed)



SUPERVISOR'S EMPLOYEE INJURY REPORT

This report is to be initiated by the employee's supervisor. Please answer all questions completely. This report must be forwarded to the appropriate health and safety representative within 24 HOURS of the injury/illness.

EMPLOYEE

Injured Name _____ Sex _____ S.S. No. _____ Birth Date _____

Home Address _____

City _____ State _____ Zip _____ Phone () _____

Job Title _____ Hire Date _____ Hourly Wage _____

Date of Incident _____ Time _____ Time Reported _____ To Whom? _____

Project/Location Name _____ Address _____

Project No. _____ Time Shift Began _____ Did the Employee Leave Work ☐ No ☐ Yes When _____

Has employee returned to work? ☐ No ☐ Yes When _____ Did employee miss a regularly scheduled shift? ☐ No ☐ Yes

Doctor/Hospital Name _____ Address _____

Witness Name(s) _____ Statement Attached? ☐ No ☐ Yes

Nature of Injury _____ Exact Body Part _____

Medial Attention: ☐ None ☐ First Aid On Site ☐ Doctor's Office ☐ Hospital ER ☐ Hospitalized

Job Assignment at Time of Incident _____

Describe Incident _____

SUPERVISOR

What Unsafe Condition and/or Act Contributed to the Incident? _____

What Corrective Action Has Been Taken to Prevent Recurrence? _____

Supervisor _____

(Print)

Signature

Date

MANAGER

Comments on Incident and Corrective Action _____

Project/Location Mgr. _____

(Print)

Signature

Date

HEALTH AND SAFETY

Concur With Action Taken ☐ No ☐ Yes Remarks _____

OSHA Classification:

☐ First Aid ☐ Recordable, No Lost/Restricted Workdays ☐ Recordable, Lost Workdays ☐ Recordable, Restricted Activity ☐ Fatality

Days Away From Work _____ Days Restricted Work _____

All injuries/illnesses requiring outside medical treatment must be reported to Corporate Human Resources Office at (913) 814-9994.

Workers' Compensation Claim Number (if applicable) _____

Health and Safety Representative: _____

(Print)

Signature

Date

Appendix B
Activity Hazard Analyses

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

ACTIVITIES	POTENTIAL HAZARDS	RECOMMENDED SAFE WORK PRACTICES & CONTROLS
<p>Construction activities associated with transmission pipe installation activities:</p> <ul style="list-style-type: none"> • Trenching and spoils management • Installation underground piping • Pipeline connections to wells • Installation of well vaults and wellhead surface completions • Trench / excavation backfill activities • Directional boring/drilling 	<ul style="list-style-type: none"> • Trenching and excavation hazards (general) • Contaminated soil - COCs • Overhead power lines • Intrusive activities • Heavy construction equipment • Weather • Fire • Moving/operating parts and small equipment • Open trenches / excavations • Noise • Hazardous atmospheres • Dust • Slips, trips, and falls • Manual lifting • Heat stress 	<p>General:</p> <ul style="list-style-type: none"> • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear steel-toed footwear. • Wear high-visibility construction vests. • Wear hearing protection as necessary in vicinity of loud equipment. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking shall only be permitted in approved areas. <p>Trenching and excavation hazards (general):</p> <ul style="list-style-type: none"> • Document the existence of underground pipes, electrical equipment, telephone, gas lines, etc. prior to excavating. • For excavations exceeding 5 ft bgs, slope or bench the sidewalls in accordance with OSHA standards (29 CFR 1926 Subpart P); alternately, use a trench box • Place spoil piles at least 2 feet from the edge of open excavations • Daily inspections shall be conducted by a “competent person” and documented on Arrowhead’s Trench/Excavation Inspection Checklist. • Operations shall be suspended and ignition sources eliminated if a hazardous atmosphere is confirmed (using a CGI/Oxygen meter) or suspected. • Personnel entry into any excavation 5 feet deep or greater shall only be permitted if the necessary protective systems (sloping, benching, or trench box) are in place.

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

		<ul style="list-style-type: none"> • Excavations greater than 4 feet in depth that require personnel to enter shall have sufficient means of entry and egress (i.e. ladders); ladders shall extend at least 3 feet above grade. • Means of entry/egress shall not require personnel to travel laterally more than 25 feet. • To minimize the accumulation of surface water within the trenches, construct dikes, ditches, and/or berms as necessary. • Implement water pumping systems as necessary. . <p>Contaminated Soil (COCs) - Routine engineering and administrative control measures for COC exposure during excavation work shall include, but not be limited to:</p> <ul style="list-style-type: none"> • Continuous particulate / dust monitoring to ensure ambient dust levels are maintained safety below site-specific action levels and PELs / TLVs • Use of PPE as required, including gloves; coveralls as needed based on site conditions • Aggressive dust suppression, including water spraying (see below for further details) • Emphasis on personal hygiene practices, such as washing hands and face at the end of work shifts • Prohibited eating, drinking, and smoking in regulated areas • Suspending or restricting work activities when dust levels become elevated or when the wind speed is excessive • Ensure adequate ventilation • Positioning personnel upwind • Upgrade to Level C respiratory protection (half-face APR) as necessary for prolonged, high visible dust episodes <p>Overhead power lines:</p> <ul style="list-style-type: none"> • Equipment operators must remain aware of overhead power lines and maintain safe clearances - use spotters when necessary. • A site layout plan shall be completed prior to mobilizing heavy equipment. The plan shall identify all overhead and underground
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

		<p>hazards.</p> <ul style="list-style-type: none">• In accordance with OSHA standards (29 CFR 1926.550 and 1910.33), a minimum clearance of 10 feet must be maintained between mechanical equipment and energized overhead power lines. This clearance distance must be increased by 4 inches for every 10 kV over 50 kV. If it necessary to approach closer than 10 feet from a power line, one of the two following options will be implemented in accordance with the OSHA standard: (1) the line will be will be de-energized and grounded, or (2) an insulating barrier will be erected to prevent contact with the line. The barrier must be rated for the voltage of the line to be guarded. These options, if needed, will be implemented by the applicable utility company.• During operations near overhead power lines, one person involved in the operation (or the SSHO) will be assigned the duty of “observer” to visually monitor the operation and provide timely warning to equipment operators in the event the minimum clearance distance is violated. In accordance with OSHA standards, the observer will be positioned “so as to be able to visually monitor the clearance between the equipment and power lines.” The observer cannot be assigned other duties that would interfere with the ability to provide safety oversight and time warnings. <p>Intrusive activities: Before any intrusive activity begins, positive steps shall be taken to determine the locations of underground utilities. Personnel shall always be alert for marking tape, wires, pipes, previously disturbed soils, crushed stone or sand bedding/backfill, discolored soil, and other indications of the presence of buried utility lines. The following procedure shall be followed to identify the locations of buried utilities prior to commencing intrusive activities. Intrusive activities shall not begin until the SSHO and Site Supervisor have signed off on the Utility Clearance Form and have issued an Intrusive Activities Permit. Both of these forms are provided in Appendix A.</p> <ul style="list-style-type: none">• The SSHO shall contact the utility locating hot to notify them of
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

		<p>intent to initiate intrusive activity at the given property location. This notification is to be made a minimum of two working days prior to the initiation of intrusive activity.</p> <ul style="list-style-type: none">• The SSHO shall contact the utility companies or other responsible authorities to assist in locating and marking the locations of the underground utilities.• The SSHO will ensure that underground utilities have been located and marked on the ground (using stakes, flags, and/or spray paint).• The SSHO shall document utility clearances on the Utility Clearance Form (Appendix A).• Once the clearance process is completed, the SSHO will issue an Intrusive Activities Permit (Appendix A). The signatures of the SSHO and Site Supervisor shall be obtained on the Clearance Permit before beginning intrusive activities.• A safety meeting shall be held by all personnel involved in intrusive activities prior to initiating work. <p>Heavy construction equipment:</p> <ul style="list-style-type: none">• Only trained/qualified personnel shall be permitted to operate heavy construction / earthmoving equipment.• Backup alarms must be operational.• Wear safety belts.• Unless the operator gives an “all clear” signal, ground personnel shall not be permitted to approach heavy construction equipment in operation.• Ground personnel shall not position themselves between heavy construction equipment and a stationary object.• Ground personnel working near heavy construction equipment shall wear high visibility vests.• Spotters shall assist trucks when backing is necessary.• Rigging shall be inspected before each use.• Rigging found to be unsafe shall be taken out of service and tagged accordingly.• Inspect equipment daily (see checklist items below; also, refer to Arrowhead’s Heavy Equipment Initial Inspection Checklist and
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

		<p>Daily Inspection Checklist).</p> <ul style="list-style-type: none"> • Equipment found to be defective shall be taken out of service and tagged accordingly. • Keep loose clothing and hair away from moving parts of heavy equipment, and avoid wearing jewelry. • Operate equipment in accordance with the manufacturer's instructions and recommendations, as presented in equipment-specific O&M manuals. • Shut down and lock out heavy equipment to prevent operation while repairs, adjustments, or preventative maintenance tasks are being performed. • No guard or device will be removed from machinery, or made ineffective except while performing repairs, preventative maintenance, or adjustments, and then only after the power has been shut off; all guards and devices will be replaced immediately after completion of the work and before power is restored. • Equipment shall be inspected regularly to check for unusual noises, loose connections, vibrations, misalignment, etc. that may be indicative of malfunction. • All components of heavy equipment that have a direct bearing on the safety of the operation shall be inspected at the beginning of each shift and when possible, observed during operation. • Equipment shall not be used if it is not in a safe operating condition. • A copy of the equipment operating manual shall be available at the job site. <p>Weather: Weather conditions shall be monitored. Operations shall cease during high wind or electrical storms or when electrical storms are imminent.</p> <p>Fire: Smoking will only be permitted in designated areas. Equipment will not be parked in tall grass areas. Fire extinguisher shall be provided.</p> <p>Small equipment and power tools: Hand and power tools shall be used, inspected, and maintained in</p>
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

		<p>accordance with the manufacturer's instructions and recommendations and will be used only for the purpose for which designed. The following requirements shall be followed:</p> <ul style="list-style-type: none">• The tool housing will be checked to be sure it is in good condition (i.e., free of cracks and defects).• If provided, trigger locks (to prevent accidental activation) will be checked for proper function prior to using the tool.• Tools designed to accommodate guards will be equipped with the guards when in use.• Reciprocating, rotating, and moving parts of equipment shall be guarded whenever possible if exposed to contact by workers.• Moveable guards shall operate freely.• Tools shall be inspected to ascertain safe operating condition and are to be kept clean and free of accumulated dirt.• Electric power tools and extension cords shall be used with ground fault circuit interrupter (GFCI).• If the tool is not three-wire ground protected, it will be double-insulated.• Portable power cords will be designated as hard usage or extra hard usage and shall not be used if damaged, patched, oil-soaked, worn, or frayed.• For pneumatic power tools, compressed air hoses will be in good condition (no visible cracks, bubbles, or kinks) and hose connections shall be secured such that there are no noticeable air leaks.• Hydraulic tools will be checked to be sure there is no fluid leakage, hydraulic lines are in good condition (no visible cracks, bubbles, or kinks), and connections are secure.• The motor, muffler, spark plugs, and other components of gasoline-powered tools will be checked to be sure they are in good condition. The tools will also be checked for signs of fuel leakage around the gasoline tank or fuel line.• Personnel shall be aware of pinch-point hazards and work in a manner to prevent injuries. Hands shall be kept out of areas that
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

		<p>may present a pinching hazard and personnel shall not position themselves between equipment.</p> <ul style="list-style-type: none">• Construction crew members shall not wear loose clothing or jewelry.• The operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment prior to starting or engaging equipment.• Personnel shall be aware of and avoid hot surfaces from heat generated from engine and friction. <p>Open trenches / excavations: Open trenches (in progress of being excavated) shall be covered, secured, and barricaded when work is not in progress.</p> <p>Noise: Personnel shall wear hearing protection to reduce exposures to below the OSHA limits.</p> <p>Hazardous atmospheres: Air monitoring shall be performed in areas where there is the possibility of elevated concentrations of toxic chemicals, flammable vapors, or oxygen deficient atmospheres. Personnel shall immediately notify the SSHO if odors are detected. Engineering controls shall be implemented, when feasible, to control hazardous atmospheres to within acceptable limits. When engineering controls are not adequate, administrative controls or the use of PPE is required.</p> <p>Dust: Personnel shall avoid working in dust. Air monitoring shall be performed as required. Visible dust emissions shall be controlled using water suppression methods.</p> <p>Slips, trips, falls: Keep work areas clear and maintain housekeeping. Personnel shall not jump from equipment or elevated surfaces. Personnel shall avoid walking on rough or slippery terrain. Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard).</p>
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

		<p>Manual lifting:</p> <ul style="list-style-type: none">• No individual employee is permitted to lift any object that weighs over 60 pounds. Multiple employees or the use of mechanical lifting devices are required for objects over the 60-pound limit. Use mechanical material handling equipment whenever practical; however, mechanical lifting equipment shall be used only by qualified personnel. Use handling aids such as dollies, carts, or hand trucks when necessary.• If the material must be lifted manually make certain that the load lifted can be safely handled. Consider the size, weight, and shape of the load. Warm up for the lift by bending, stretching, and turning.• Bend at the knees to grasp the load. Lift gradually, using your leg muscles. Make sure you draw the load close to your body. Do not twist the body when lifting. If you have to change direction, turn with your feet, not your trunk.• Carry the object close to the body and watch where you are going. Do not carry objects in a manner that obstructs your vision.• Avoid throwing or dropping objects. When lowering, maintain a firm grip. Watch out for pinching of the fingers. Use your leg muscles to lower the object by bending at the knees and keeping your back straight. <p>Heat stress:</p> <ul style="list-style-type: none">• Acclimatize workers to hot working conditions.• Provide plenty of liquids to replace the body fluids lost by perspiration.• Provide personal cooling devices.• Conduct strenuous field operations in the early morning if possible.• Rotate personnel to various job duties.• Establish adequate work/rest cycles.• Monitor heart rate and/or body temperature as appropriate.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Excavator • Skid-Steer Loader • Water truck • Trash pump • Personal protective equipment (PPE) as listed below • Leather gloves • Hard hats • Steel-toed footwear • Fire extinguisher • High visibility vests • Hand tools • Air monitoring – <u>PID, CGI/O2, aerosol monitor</u> • Hearing protection 	<ul style="list-style-type: none"> • Intrusive activities clearance request form completed • Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) • Inspect hand and power tools prior to use (see checklist items below) • Inspect ladders prior to use • Inspect PPE prior to use • Inspect/mark areas of intrusive work for the presence of underground utility lines; complete Utility Clearance Form) • Inspect heavy construction equipment upon receipt (see Heavy Equipment Initial Inspection Checklist) • Inspect heavy equipment daily (see checklist items below; also, see Heavy Equipment Daily Inspection Checklist) • Inspect conditions associated with trenches/excavations daily (see Trench / Excavation Checklist) 	<ul style="list-style-type: none"> • Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Emergency Response Plan, including facility-specific evaluation routes and location of severe weather shelter areas. • Review hazard communication requirements, including applicable MSDSs. • Heavy equipment operators shall be properly trained, certified, and/or licensed for the specific piece of equipment as required

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Material Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are heat stress monitoring instruments (i.e. thermometers) available and ready for use?
19. Are sanitation facilities (i.e. hand wash) and supplies available on site?
20. Are toilet facilities clean?

Inspection Items for Hand and Power Tools

1. All tools operated according to manufacturer's instructions and design limitations.
2. All hand and power tools maintained in a safe condition and tested before use.
3. Tools are tested daily to assure safety devices are operating properly.
4. Defective tools are tagged and removed from service until repaired.
5. PPE is selected and used according to tool-specific hazards anticipated.
6. Power tools are not carried or lowered by their cord or hose.
7. Power operated tools designed to accommodate guards have guards installed.
8. Guards are provided at point of operation, nip points, rotating parts, etc.
9. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.
10. Tools are stored properly.
11. Cordless tools and recharging units both conform to electrical standards and specifications.

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

12. Knife or blade hand tools are used with the proper precautions.
13. Damaged tools are removed from service until repaired.
14. Floor and bench-mounted grinders are provided with properly positioned work rests.
15. Electric tools are approved double insulated or grounded and used according to SOP HS-23.
16. Electric tools are used with a GFCI.
17. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.
18. Wrenches are not used when jaws are sprung to the point of slippage.
19. Impact tools are kept free of mushroomed heads.
20. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool.

Inspection Items for Heavy Construction Equipment

1. Personnel maintaining safe distance from operating equipment
2. Positioning personnel in close proximity to operating equipment is avoided
3. Personnel wearing high-visibility and/or reflective vests when close to operating equipment
4. Personnel approach operating equipment safely
5. Personnel riding only in seats of equipment cab and using seat belts
6. Personnel not positioned under elevated portions of equipment
7. Personnel not positioned under hoisted loads
8. Personnel not hoisted by equipment
9. Personnel do not approach equipment that has become electrically energized
10. Personnel wearing appropriate PPE
11. Only qualified and authorized personnel operating equipment
12. Daily safety briefing/meeting conducted with equipment operators
13. Daily inspection of equipment conducted and documented
14. Modifications and attachments used approved by equipment manufacturer
15. Backup alarm operational; or, spotter used when backing equipment
16. Operational horn provided on bi-directional equipment
17. Seat belts are provided and used
18. Rollover protective structures (ROPS) provided
19. Braking system capable of stopping full payload
20. Headlights and taillights operable when additional light required
21. Brake lights in operable condition
22. Cab glass provides no visible distortion to the operator
23. All machine guards are in place
24. Hauling equipment (dump trucks) provided with cab shield or canopy

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

25. Dump truck beds provided with positive means of support during maintenance or inspection
26. Dump truck operating levers provided with latch to prevent accidental dumping
27. Equipment position on firm/level surface, outriggers used
28. Location of underground utilities identified
29. Safe clearance distance maintained while working under overhead power lines
30. Safe distance is maintained while traveling under power lines
31. Warning system used to remind operator of excavation edge
32. Unattended equipment visibly marked at night
33. Tools lowered/parking brake set when not in use, wheels chocked when parked on incline
34. Equipment operated on safe roadways and grades
35. Equipment operated at safe speed
36. Operators maintain unobstructed view of travel path
37. Equipment not operated during inclement weather, lightning storms
38. Equipment started and moved safely
39. Operators keep body parts inside cab during operation
40. Vehicle occupants in safe position while loading/unloading
41. Signal person visible to operator when required
42. Equipment used for hoisting done according to equipment manufacturer specifications
43. Lifting and hauling capacities are not exceeded
44. Defective components repaired immediately
45. Suspended equipment or attachments supported prior to work under or between
46. Lockout/tagout procedures used prior to maintenance
47. Tires on split rims removed using safety tire rack or cage
48. Good housekeeping maintained on and around equipment

Arrowhead Contracting, Inc. Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: Trenching and Yard Pipe Installation

Prepared by: Scott Siegwald, CIH, 07-02-14

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

[illegible]

[illegible]

Hemlock Directional Boring, Inc.

Site-Specific Health, Safety and Accident Prevention Plan

GENERAL INFORMATION

Client/Site Name: Arrowhead Contracting, Inc./Old Roosevelt Field Superfund Site
Site Address: Old Roosevelt Field, Garden City, NY
Job/Project #: 315-001
Estimated Start Date: 8/1/14 Estimated Completion Date: 11/1/14

EMERGENCY INFORMATION

Phone Numbers: Hospital #: (516) 663-0333 Ambulance #: 911
Fire #: 911 Police #: 911
Hospital Name & Address: Winthrop-University Hospital
259 First Street Mineola, NY 11501-3987
Directions and Street Map of Route to Nearest Hospital Attached: ☒ Yes ☐ No (if no, do not proceed)
Other Emergency Contact: Phone #:
Location of Nearest Phone: Cell phone on-site

Have Necessary Underground Utility Notifications for Subsurface Work Been Made? ☒ Yes ☐ Not Applicable
Specify Clearance Date & Time, Dig Safe Clearance I.D. #, And Other Relevant Information:

SCOPE OF WORK

Site Description: Installing Water Treatment lines and Control Wiring Conduits

Specific Tasks Performed by Hemlock Directional Boring: Directional Drilling and Open Cut Excavation

Concurrent Tasks to be Performed by Subcontractors (List Subcontractors by Name): None

Concurrent Tasks to be Performed by Others: None

Does this project include confined space entry? ☐ Yes ☒ No

ROLES AND RESPONSIBILITIES:

ON-SITE PERSONNEL

Name	Project Title/Assigned Role	Telephone Numbers
Kenneth Traub	Project Manager	work: 860-482-7509 cell: 860-601-8903
Samantha Traub	Site Supervisor/Safety Officer	work: 860-482-7509 cell: 860-601-8915
David Bousquet	Site Foreman/Competent Person	work: 860-482-7509 cell: 860-601-1117
Robert Hyland	Drilling Supervisor/Competent Person	work: 860-482-7509 home: 860-601-8907

Site Supervisors and Project Managers (SS/PM): Responsibility for compliance with Health and Safety programs, policies, procedures and applicable laws and regulations is shared by all management and supervisory personnel. This includes the need for effective oversight and supervision of project staff necessary to control the Health and Safety aspects of on-site activities.

Site Safety Officers and Competent Persons (SSO/CP): The Site Safety Officer (SSO) or "Competent Person", as defined by OSHA 1926.20(b) - Accident Prevention Responsibilities, is the individual "who is capable of identifying existing and predictable hazards in surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." The SSO is designated on a site-by-site basis based on the site conditions, scope-of-work, and the individual's ability to recognize site-specific hazards and take appropriate corrective actions. This individual is responsible to both project management and the designated HSC with regard to the completion of these assigned duties.

First Aid Personnel: In accordance with OSHA 1926.50, at least one individual designated by who has current (Red Cross or equivalent) training and certification in basic first aid and cardiopulmonary resuscitation (CPR) must be present during on-site activities involving multiple personnel. This person must also have received training and information regarding the company's Bloodborne Pathogen control program, including the required use of "universal precautions" and the availability of HBV vaccinations.

Staff: Ultimate control of Health and Safety is in the hands of each individual employee. Therefore, each employee must become familiar with and comply with all Health and Safety requirements associated with their position and daily operations. Employees also have the responsibility to notify the appropriate management, SSO and HSC of unsafe conditions and accidents/injuries immediately. When employees are issued respirators or any other personal protective equipment (PPE), they are responsible for ensuring that said items are used properly, cleaned as required and maintained in good working order.

(Sub)contractors: (Sub)contractors must develop their own accident prevention plan related to their specific on-site activities. Subcontractors may use the company's plan as an informational model. However, each Subcontractor is responsible for determining the plan's adequacy a

OTHER PROJECT PERSONNEL:

Name	Project Title/Assigned Role	Telephone Numbers
Kenneth Traub	Project Director (PD)	Work: 860-482-7509 Cell: 860-601-8903
Kenneth Traub	Project Manager	Work: 860-482-7509 Cell: 860-601-8903
Kenneth Traub	Health and Safety Coordinator (HSC)	Work: 860-482-7509 Cell: 860-601-8903
Thomas Stark	Health and Safety Consultant	Work: 860-875-7655 Home: 860-429-6233 Pager: 860-250-8205

PLAN ACKNOWLEDGMENT AND APPROVALS

Approval or Acknowledgment	SSO/CP	SS/PM	PD	HSC
Probable hazards identified on form.		X		X
Project scope accurately reflected on form.		X	X	
Appropriate emergency response information identified on form.		X		X
Appropriate control measures identified on form.		X		X
Hazards and control measures to be implemented on site acknowledged.	X		X	
Overall project scope and health and safety requirements acknowledged.	X		X	

DOCUMENTATION TO BE COMPLETED ON SITE

- A **Site Inspection Log** (page 11) must be completed at the initiation of on-site activities and at least once per week thereafter until the completion of on-site activities.
- A **Site Health and Safety Briefing/ Site Orientation Record** (page 12) must be completed at the initiation of on-site activities and at least once per week thereafter until the completion of on-site activities. (Note: The actual briefing may be conducted off site, in the office for example, if conditions preclude or render impractical its completion on site.)
- The **Subcontractor's Statement of Understanding Regarding Health and Safety Responsibilities** (page 13) and the **Incident Report and/or Discovery of a Potential Hazard** (page 14) are to be completed on an as needed basis.

EQUIPMENT AND CONTROLS

<p>Monitoring Equipment ¹</p> <p><input checked="" type="checkbox"/> PID Type: _____ Lamp Energy: <u>10.6</u> eV</p> <p><input type="checkbox"/> FID Type: _____</p> <p><input type="checkbox"/> Cal gas and equipment type: _____</p> <p><input type="checkbox"/> LEL/O₂ Meter</p> <p><input type="checkbox"/> Others: _____</p> <p>Other Equipment & Gear ²</p> <p><input checked="" type="checkbox"/> 10# ABC Fire Extinguisher when gasoline powered equipment is present</p> <p><input checked="" type="checkbox"/> Caution Tape</p> <p><input checked="" type="checkbox"/> Traffic Cones or Stanchions</p> <p><input checked="" type="checkbox"/> Warning Signs or Placards</p> <p><input checked="" type="checkbox"/> Decon Buckets, Brushes, Detergent, Towels and Plastic Bags</p> <p><input type="checkbox"/> Others: _____</p>	<p>Personal Protective Equipment</p> <p><input checked="" type="checkbox"/> Respirator Type: _____</p> <p><input checked="" type="checkbox"/> Resp-Cartridge Type: _____</p> <p><input checked="" type="checkbox"/> Hearing Protection</p> <p><input checked="" type="checkbox"/> Hardhat</p> <p><input checked="" type="checkbox"/> Outer Gloves Type: _____</p> <p><input type="checkbox"/> Inner Gloves Type: _____</p> <p><input checked="" type="checkbox"/> Steel-toed boots/shoes</p> <p><input checked="" type="checkbox"/> Coveralls Type: _____</p> <p><input type="checkbox"/> Outer Boots Type: _____</p> <p><input checked="" type="checkbox"/> Eye Protection with side shields</p> <p><input checked="" type="checkbox"/> Traffic Vest</p> <p><input type="checkbox"/> Personal Flotation Device (PFD)</p> <p><input type="checkbox"/> Others: _____</p>
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1. All direct reading instruments must be referenced on-site at least twice/day (pre- and post-sampling) using a cal-gas reference standard and in accordance with the manufacturer's instructions. Monitoring using direct reading instruments should be frequent while there is disturbance of material (e.g. soil).
2. A 15- to 25-foot exclusion zone is required wherever necessary to control access to heavy equipment and/or hazardous exposure situations.

AIR MONITORING INSTRUMENTS AND ACTION LEVELS:

Anticipated Chemical Hazards: PAHs, arsenic, lead on-dust; volatile organic compounds (VOC's) particularly tetrachloroethylene in breathing zone.

Organic Vapor Detector (H-Nu, OVM, OVA) - Breathing Zone Readings (will be completed by HSC):

<p><u>0</u> to <u>5</u> units</p>	<p>Remain in Level D. If reading above sustained for 30 seconds use colorimetric tubes or other chemical specific device to verify PID readings do not contain low PEL toxic materials (Benzene, Vinyl Chloride, etc.) Cease work and consult with DHSC if levels of benzene or vinyl chloride exceed 1 ppm on the color metric tubes.</p>
<p><u>5</u> to <u>10</u> units</p>	<p>Withdraw from work area and contact Project Management if sustained for 1 minute. Proceed to Level C protection for re-entry or discontinue operation. Obtain samples of slurry for broad VOC scan.</p>
<p>> <u>10</u> units</p>	<p>Secure operations, withdraw from work area and discontinue work at that location until contaminants can be evaluated and detailed plan (SSHP) implemented.</p>

Combustible Gas Indicator CGI/LEL Meter (if required) - Readings Near Vapor Source:

<ul style="list-style-type: none"> • < 10% LEL: 	<p>Continue to monitor with caution. Eliminate all ignition sources.</p>
<ul style="list-style-type: none"> • 10% to 20% LEL: 	<p>Stop operations until appropriate vapor control measures (i.e. foam, sand, polyethylene, film, portable blower etc.) and resample before resuming activity.</p>
<ul style="list-style-type: none"> • > 20% LEL: 	<p>Stop operations and withdraw from area. Contact DHSC before proceeding.</p>

HAZARD ASSESSMENT

Enter either: **X** (*applies, or required item(s) available*) or **NA** (*not applicable*)

HAZARD ASSESSMENT: PHYSICAL HAZARDS AND RELATED CONCERNS

☐ **Confined Space Entry (CSE).** Confined space entry means the *potentially hazardous* entry into any space which, by design, has limited openings for entry and exit, unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy. Confined space entry should be allowed only when absolutely necessary.

☒ **Construction Hazards, Drill Rigs, Backhoes, etc.** The use of drill rigs, backhoes and other heavy equipment represent potentially serious construction hazards. Whenever such equipment is used, personnel in the vicinity should be limited to those who must be there to complete their assigned duties. All personnel must avoid standing within the turning radius of the equipment or below any suspended load. Job sites must be kept as clean, orderly and sanitary as possible.

Never turn your back to operating machinery. Never wear loose clothing, jewelry, hair or other personal items around rotating equipment or other equipment that could may catch or ensnare loose clothing, jewelry, hair or other personal items. Always stand far enough away from operating machinery to prevent accident contact which may result from mechanical or human error.

The following basic personal protective measures must be observed: **Hardhats** must be worn. **Safety glasses** must be worn. **Steel-toed safety boots** are also required.

☒ **Heat and Cold Stress.** Overexposure to temperature extremes can represent significant risks to personnel if simple precautions are not observed. Typical control measures include dressing properly, drinking plenty of the right fluids, and establishing an appropriate work/break regimen.

☒ **Moving Vehicles, Traffic Safety.** All vehicular traffic routes which could impact worker safety must be identified and communicated. Whenever necessary, barriers or other methods must be established to prevent injury from moving vehicles. Traffic vests must be worn by personnel working near moving vehicular traffic.

☒ **Noise.** In order to reduce the exposure to this noise, personnel working in areas of excessive noise must use hearing protectors (ear plugs or ear muffs).

☒ **Overhead Utilities and Hazards.** Overhead hazards include *falling objects, suspended loads, swinging loads and rotating equipment*. Hardhats must be worn by personnel in areas where these types of physical hazards may be encountered.

☒ **Test Pit and/or other Excavations.** All provisions of the OSHA trenching and excavation standard (29 CFR 1926.650-652) must be followed during excavation activities. A ladder or similar means of egress must be located in excavations greater than 4 feet in depth so as to require no more than 25 feet of lateral travel for employees. *No person should be allowed to enter an excavation in type B or C soil greater than 5 feet in depth unless the walls of the excavation have been protected using an approved shield (trench box), an approved shoring system.* Excavation should never be left open unless absolutely necessary, and then only with proper barricading and controls to prevent accidental injury.

☒ **Underground Utilities and Hazards.** *The estimated location of utility installations, such as sewer, telephone, electric, water lines and other underground installations that may reasonably be expected to be encountered during excavation work, must be determined prior to opening an excavation. Where other underground hazards may exist, reasonable attempts must be made to identify their locations as well. Failure to identify underground hazards can lead to fire, explosion, flooding, electrocution or other life threatening accidents.*

HAZARD ASSESSMENT: CHEMICAL HAZARDS AND RELATED CONCERNS

☒ **BTEX Compounds.** Exposure to the vapors of gasoline, **benzene, ethyl benzene, toluene and xylenes** above their respective permissible exposure limits (PELs), may produce irritation of the mucous membranes of the upper respiratory tract, nose and mouth. Overexposure may also result in the depression of the central nervous system. Symptoms of such exposure include drowsiness, headache, fatigue and drunken-like behavior.

☒ **Petroleum Hydrocarbons (PHCs).** Petroleum Hydrocarbons such as fuel oil are generally considered to be of low toxicity. Recommended airborne exposure limits have not been established for these vapors. However, inhalation of low concentrations of the vapor may cause mucous membrane irritation. Inhalation of high concentrations of the vapor may cause pulmonary edema. Repeated or prolonged direct skin contact with the oil may produce skin irritation as a result of defatting. Protective measures, such as the wearing of chemically resistant gloves, to minimize contact are addressed elsewhere in this plan. Because of the relatively low vapor pressures associated with PHCs, an inhalation hazard in the outdoor environment is not likely.

HAZARD ASSESSMENT: BIOLOGICAL HAZARDS AND RELATED CONCERNS

- ☒ **Insects.** Insects represent significant sources (vectors) of disease transmission. Therefore, precautions to avoid or minimize potential contact should be considered prior to all field activities. Stinging insects, such as bees and wasps, are prevalent throughout the country, particularly during the warmer months. The stings of these insects can be painful, and cause serious allergic reactions to some individuals.
- ☒ **Lyme Disease.** Lyme disease is an infection caused by the bite of certain ticks, primarily deer, dog and wood ticks. The following steps are recommended for prevention of Lyme disease and other diseases transmitted by ticks: a) Beware of tall grass, bushes, woods and other areas where ticks may live; b) *Wear good shoes, long pants tucked into socks, a shirt with a snug collar, good cuffs around the wrists and tails tucked into the pants. Insect/tick repellents may also be useful;* c) *Carefully monitor for the presence of ticks.*
- ☒ **Poisonous Plants.** The possible presence of poisonous plants should be anticipated for field activities in wooded or heavily vegetated areas. *Poison ivy* is a climbing plant with alternate green to red leaves (arranged in threes) and white berries. *Poison oak* is similar to poison ivy and *sumac* but its leaves are oak-like in form. The leaves of these poisonous plants produce an irritating oil which causes an intensely itching skin rash and characteristic blister-like lesions. Contact with these plants should be avoided.

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(Please sign and date. See page 3 for Acknowledgment and Approval scope.)

SS/PM:_____

HSC: _____

Attachment A	Site Inspection Log
Attachment B	Health and Safety Briefing/Site Orientation Record/Hazard Communication
Attachment C	Subcontractor's Statement of Understanding
Attachment D	Incident Report and/or Discovery of a Potential Hazard

(Revised January 2001)

Attachment A

Site Inspection Log

PROJECT NAME: Old Roosevelt Field Superfund Site	LOCATION: Garden City, NY
PROJECT NUMBER: 315-001	DATE:
PROJECT MANAGER: Kenneth Traub	COMPLETED BY:
SITE DESCRIPTION AND NATURE OF WORK: Horizontal Directional Boring and Open Cut Excavation for Piping	

HAZARD COMMUNICATION

- ☐ Chemical hazards identified
- ☐ All containers properly labeled
- ☐ MSDS/workplace notebook on site
- ☐ Site safety briefing completed and documented

ACCIDENTS/EMERGENCY INFO

- ☐ First aid personnel identified
- ☐ Hospital location identified
- ☐ Police/Fire/Ambulance phone numbers available
- ☐ Incident investigation forms available
- ☐ Fire extinguisher present

SANITATION

- ☐ Washing facilities available
- ☐ Toilet facilities available
- ☐ Approved trash receptacle available
- ☐ Water/refreshments available

STORAGE

- ☐ Tools/Drill tooling/supplies safely stacked to prevent rolling or collapse
- ☐ Work areas and passage ways kept clear

HOUSEKEEPING

- ☐ Work areas clean and orderly
- ☐ Storage areas clean and orderly
- ☐ Combustible scrap/debris removed regularly
- ☐ Waste containers of flammable or toxic materials covered

OVERHEAD HAZARDS

- ☐ 15^{ft} minimum clearance maintained
- ☐ All sources of falling objects/swinging loads/rotating equipment identified
- ☐ Barriers or other methods in place to prevent injury due to overhead hazards

POSTING

- ☐ Emergency phone/contact info posted
- ☐ OSHA poster displayed

UNDERGROUND HAZARDS

- ☐ All underground hazards identified and communicated to workers on site
- ☐ Utility/Dig-Safe clearance confirmed
- ☐ Clearance dates: _____
- ☐ Clearance ID#: _____

EXCAVATIONS and TRENCHES

- ☐ All personnel and storage at least 2^{ft} from top edge of excavation
- ☐ Ladder in place
- ☐ Guarding/barriers in place

VEHICULAR TRAFFIC

- ☐ All vehicular traffic routes which could impact worker safety identified and communicated
- ☐ Barriers or other methods established to prevent injury from moving vehicles

PEDESTRIAN TRAFFIC/SITE CONTROL

- ☐ All walkways which could be impacted by site activities identified and communicated
- ☐ Barriers or other methods established to prevent pedestrian injury from site activities

ENVIRONMENTAL HAZARDS

- ☐ Poisonous plants/stinging or biting insects/vermin/sewage/etc. identified and communicated

COMMENTS/OTHER HAZARDS _____

x = OK

NA = Not Applicable

Attachment E

Confined Space Inspection Log

PROJECT NAME: Old Roosevelt Field Superfund Site	LOCATION: Garden City, NY
PROJECT NUMBER: 315-001	DATE:
PROJECT MANAGER: Kenneth Traub	COMPLETED BY:
SITE DESCRIPTION AND NATURE OF WORK: Horizontal Directional Boring and Open Cut Excavation for Piping	

HAZARD ASSESMENT

- ☐ Flooding of the Casing
- ☐ Collapse of Boring Face
- ☐ Temperature/Physical Exhaustion
- ☐ Air Quality

ACCIDENTS/EMERGENCY INFO

- ☐ Safety Watch Appointed
- ☐ First aid personnel identified
- ☐ Hospital location identified
- ☐ Police/Fire/Ambulance phone numbers available
- ☐ Incident investigation forms available
- ☐ Fire extinguisher present

FLOODING OF CASING

- ☐ Initial Ground Water Levels Monitored
- ☐ Proximity to Existing Water Main
- ☐ Distance to Standing Water (Pond, Stream, Lake)
- ☐ Dewatering Equipment and Backup

COLLAPSE OF BORING FACE

- ☐ Visual Inspection of Boring Face
- ☐ Assess Removal Techniques of Obstruction
- ☐ Work Obstruction Removal From Top to Bottom
- ☐ Keep Limbs Within the Casing at All Times
- ☐ Remove Material from Casing, Avoid Piling Materials

TEMPERATURE/PHYSICAL EXHAUSTION

- ☐ Wear Appropriate Clothing into Confined Space
- ☐ Maintain Fresh Air System
- ☐ Drink Appropriate Fluids for Hydration
- ☐ Limit Work at Boring Face to 45 Minute Shifts

AIR QUALITY

- ☐ Place Fresh Air System in the Shade Away From Running Equipments Exhaust.
- ☐ Wear Air Testing Monitor in Confined Space at all Times
- ☐ Keep Fresh Air Supply Line Clear of Debris in Casing
- ☐ Use Appropriate Sized Blower(s) for Confined Space

POSTING

- ☐ Emergency phone/contact info posted

CONFINED SPACE EQUIPMENT LIST

- ☐ Air Quality Sampling Units
- ☐ Fresh Air Supply System
- ☐ Fresh Air Supply Piping
- ☐ Emergency Escape Air System
- ☐ Safety Retrieval Harnesses
- ☐ Retrieval Lines/Ropes
- ☐ Eye Protection
- ☐ Ear Protection
- ☐ Respirators
- ☐ Knee Protection
- ☐ Portable Battery Powered Lighting
- ☐ First Aid Kit
- ☐ Eye Wash
- ☐ Communication Equipment

COMMENTS/OTHER HAZARDS _____

x = OK

NA = Not Applicable

Attachment B

This is to verify that I, the undersigned, have been provided with a site (orientation) briefing, including hazard communication, regarding the safety and health considerations at Old Roosevelt Field, Garden City, NY. I agree to abide by my employer's site-specific safety and health plan and other safety or health requirements applicable to the site.

Date _____

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There is no handwriting or other markings on the paper.

Date: _____

Attachment C
Subcontractor's Statement of Understanding
Regarding Health and Safety Responsibilities

Project Name: Old Roosevelt Field Superfund Site

Project Number: 315-001

In accordance with generally accepted practices, each Subcontractor engaged by HDB is responsible for all matters relating to the health and safety of its personnel and equipment in performance of the work. This includes recognition of the potential health and safety hazards associated with the work. HDB will establish a health and safety plan or program (HASP) applicable to its own employees and its own activities on site. HDB will make its HASP available to each subcontractor for informational purposes only. Each subcontractor must establish a HASP applicable to its own employees and its own activities on site.

Subcontractors who use HDB's HASP as a model for their own HASP are responsible for determining its adequacy and applicability to its own employees and its own activities on site. Subcontractors must establish their own HASP applicable to subcontractor employees and/or activities, even if modeled after HDB's HASP and deliver this HASP in clear written form to HDB prior to the initiation of on-site activities. Submittal of the subcontractor's HASP to HDB will be for informational purposes only. Review of the subcontractor's HASP by HDB shall in no way constitute approval or endorsement by HDB of the subcontractor's HASP. It is understood that protective measures specified in the Subcontractor's HASP are minimum requirements for the work.

Subcontractor warrants that all its employees that are permitted to engage in operations that could expose them to hazardous wastes, hazardous substances, or safety or health hazards have obtained the necessary health and safety training and medical surveillance as specified in the applicable provisions of OSHA:

1926.59 Hazard Communication,
1926.52 Occupational Noise Exposure,
1926.103 Respiratory Protection,
1926.65 Hazardous Waste Operations and Emergency Response;

as well as any other applicable portion of the OSHA General Industry (29 CFR 1910) and Construction Industry (29 CFR 1926) Standards. Subcontractor shall provide HDB with evidence of the necessary certification before beginning hazardous waste work subject to OSHA 1926.65 on the project site.

Should HDB become aware of subcontractor activities on site which appear to violate OSHA or other applicable safety regulations or otherwise pose an immediate and serious threat to the safety of HDB employees, subcontractor employees, other individuals on site, or members of the public, HDB may notify the subcontractor verbally and/or in writing regarding the need for corrective action. Failure to comply with either general safety practices or health and safety practices as described above may be grounds for breach and prompt contract termination. The safety requirements of the work as described above apply without regard to time, place, or presence of a HDB representative.

THE PRESENCE OF HDB PERSONNEL ON THE SITE CARRYING OUT PROFESSIONAL ACTIVITIES DOES NOT MEAN THAT HDB UNDERTAKES TO OVERSEE THE SUBCONTRACTOR'S COMPLIANCE RESPONSIBILITIES.

The undersigned agrees that he is authorized to execute this statement of understanding on behalf of their firm:

Firm: _____

Name (Print): _____ Title: _____

Signature: _____ Date: _____

Attachment D
Incident Report and/or Discovery Of A Potential Hazard

CHECK ALL THAT APPLY: ☐ Hazard Identified ☐ Injury/Illness ☐ Property Damage

Project Name: _____ Project Number: _____ Today's Date _____

Date and Time Incident Occurred: _____ Site Supervisor's Name: _____

1) Describe the incident or potential hazard: _____

2) Machine or tools involved: _____

3) Names of employees involved in incident: _____

4) What personal protective was being worn when incident occurred? _____

5) Please answer the following four questions. For responses marked yes, please elaborate on the lines below.

Was anyone injured? ☐ Yes ☐ No Was first aid administered? ☐ Yes ☐ No

Was medical treatment sought? ☐ Yes ☐ No Was there property damage? ☐ Yes ☐ No

6) What steps were taken to prevent a reoccurrence? _____

7) What changes in process, procedure, or equipment would you recommend? _____

8) If the report is for an existing or potential hazard, has the entity controlling the hazard or potential hazard been notified in writing? ☐ Yes ☐ No

9) Additional comments _____

Name and signature of person preparing this form _____

Branch Office Manager:

Corporate Director of Health and Safety:

Health and Safety Coordinator:

Other:

Note: If the space provided on this form is insufficient, provide additional information on separate paper and attach. The completed investigation report must be submitted to the Corporate Director of Health and Safety in Newton within five days.

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction Activities

Analyzed by/date: S. Siegwald, CIH 07-02-14

ACTIVITIES	POTENTIAL HAZARDS	RECOMMENDED SAFE WORK PRACTICES & CONTROLS
<p>General and building construction / installation activities associated with the treatment building, including:</p> <ul style="list-style-type: none"> Concrete work Interior electrical and plumbing Process equipment installation Mechanical installation including above-ground piping, valves, and fittings, 	<ul style="list-style-type: none"> Eye hazards Noise Chemical exposure (operational chemicals) Dust Slips, trips, and falls Work from heights (ladders and lifts) Small hand and power tools Overhead hazards Lifting / ergonomics Material handling Forklift Electrical hazards Hazardous energy control Intrusive (underground) work Heavy construction equipment Heavy machinery Cold stress 	<p>General:</p> <ul style="list-style-type: none"> Wear protective leather gloves as necessary. Wear safety glasses. Wear hard hats. Wear steel-toed footwear. Wear hearing protection as necessary. Ensure that fire extinguishers are available to personnel. Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). Smoking shall only be permitted in approved areas. <p>Eye hazards:</p> <ul style="list-style-type: none"> Wear safety glasses with side shields at all times during construction/field activities. <p>Noise:</p> <ul style="list-style-type: none"> Wear hearing protection while operating or working near heavy construction equipment (unless inside an enclosed cab). Implement engineering controls to reduce noise levels as appropriate. Perform noise monitoring as necessary. <p>Chemical exposure (operational chemicals):</p> <ul style="list-style-type: none"> Review Materials Safety Data Sheets (MSDSs) for sealants and other chemical products Wear chemical-resistant gloves as needed Ensure adequate ventilation Follow manufacturer's recommended procedures and safety precautions for use and application

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction ActivitiesAnalyzed by/date: S. Siegwald, CIH 07-02-14

		<p>Dust:</p> <ul style="list-style-type: none">• Avoid generating dust, and allow elevated dust emissions to diminish prior to continuing work• Perform air monitoring as necessary• Use water suppression methods as necessary <p>Slips, trips, and falls:</p> <ul style="list-style-type: none">• Implement good housekeeping practices – keep the area free of materials, scrap, and debris.• Electrical extension cords and electrical wiring shall be kept clear of walking and working areas and/or covered or otherwise secured.• Clean up spills immediately.• Provide adequate illumination.• Do not jump from equipment or elevated surfaces. <p>Work from heights (ladders and lifts):</p> <ul style="list-style-type: none">• Maintain three points of contact when ascending/descending ladders.• Face the ladder, and use at least one hand to grasp the ladder when climbing.• Don't carry objects while climbing.• Don't overreach from a ladder.• Straight or extension ladders shall be 1 foot out for every 4 feet up.• For extension ladders, provide at least 3 ft of extension above the top point of support.• Ensure ladder footings are secure.• Inspect ladders prior to each use.• Ladders found to be defective shall be taken out of service and tagged accordingly. <p>Small hand and power tools:</p> <ul style="list-style-type: none">• Wear protective gloves as necessary.• Use GFCIs for all electrical-powered tools.• Maintain manufacturer safeguards on power tools.• Extension cords shall be inspected before use, protected from damage, and kept out of wet areas.• Inspect equipment daily (see checklist items below).
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction Activities

Analyzed by/date: S. Siegwald, CIH 07-02-14

		<ul style="list-style-type: none"> • Equipment found to be defective shall be taken out of service and tagged accordingly. <p>Overhead hazards:</p> <ul style="list-style-type: none"> • Wear hard hats. • Evaluate overhead hazards (including power lines) prior to allowing heavy construction equipment onto the site. • Areas with overhead hazards shall be barricaded as necessary to prevent heavy construction equipment from approaching. • Maintain a minimum distance of 10 feet from overhead power lines; provide spotters as necessary, or have the lines shielded or de-energized by the local power utility. • Ground personnel shall never stand beneath suspended loads. <p>Lifting / ergonomics:</p> <ul style="list-style-type: none"> • Avoid awkward postures, bending, twisting, and repetitive motions to the maximum extent practical. • Personnel shall not individually lift a load exceeding 60 pounds; use multiple personnel or mechanical lifting devices instead. • Use handling devices (i.e. dollies, carts, hand trucks) whenever feasible. • Use material handling equipment (i.e. forklifts, hoists) whenever feasible. • For manual lifts, bend at the knees to grasp the load, lift gradually using your legs, and keep the load close to your body; do not twist the body during the lift; if you have to turn, turn with your feet, not your trunk. • Warm up for a lift by bending, stretching, and turning. <p>Material handling:</p> <ul style="list-style-type: none"> • Be aware of sharp and jagged edges. • Be aware of and avoid pinch / nip points. • Be aware of slippery gripping surfaces. • Wear protective leather gloves as necessary. <p>Forklift:</p> <ul style="list-style-type: none"> • Only qualified personnel shall be permitted to operate forklift. All equipment shall be operated at safe speeds and in a safe manner.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction ActivitiesAnalyzed by/date: S. Siegwald, CIH 07-02-14

		<ul style="list-style-type: none">• Operators shall wear safety belts and hearing protection.• Ground personnel shall not position themselves between equipment and stationary objects and only approach equipment after a signal from the operator.• Operators must remain aware of overhead power lines and maintain safe clearances - use spotters when necessary. Personnel shall never stand under suspended loads.• Keep work areas clear and maintain housekeeping. Personnel shall not jump from equipment or elevated surfaces.• Ground personnel working near heavy construction equipment shall wear high visibility vests.• Spotters shall assist trucks when backing is necessary.• Rigging shall be inspected before each use.• Rigging found to be unsafe shall be taken out of service and tagged accordingly.• Inspect equipment daily (see checklist items below; also, refer to Arrowhead's Heavy Equipment Initial Inspection Checklist and Daily Inspection Checklist).• Equipment found to be defective shall be taken out of service and tagged accordingly. <p>Loading safety guidelines:</p> <ul style="list-style-type: none">• Make sure the load is stable before it is moved.• Move the forklift into position. Be sure the forks are adjusted to the width of the load.• Drive forward until the forks are positioned all the way into the load. Brace the load against the fork carriage.• Lift the load slightly and back out.• Tilt the mast back before you travel with the load. Travel with the load as close to the floor as possible. <p>Unloading safety guidelines:</p> <ul style="list-style-type: none">• Position the load directly over the destination.• Straighten the mast.• Slowly lower the load.• Back away slowly and make sure the forks are clear of the load before turning.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction Activities

Analyzed by/date: S. Siegwald, CIH 07-02-14

		<p>Electrical hazards:</p> <ul style="list-style-type: none"> • All portable electrical equipment and extension cords shall be protected with a GFCI as part of the circuit. • Use only three-wire ground protected or double insulated power tools. • If a tool is not three-wire ground protected, it will be double-insulated. • Wear rubber-soled shoes/boots and rubber gloves when using tools in wet locations. • To the extent practical, suspend cords above head height when it is necessary to have them across aisles or traffic areas. If cords are placed across aisles or traffic areas for prolonged periods of time, place protective strips over the cord(s). • Do not hang cords over nails, bolts, or sharp edges. • Replace damaged or frayed power cords immediately. • Immediately discontinue the use of tools that shock, smoke, smell or spark. • De-energize and lockout electrical circuits whenever possible. <p>Hazardous energy control:</p> <ul style="list-style-type: none"> • All equipment and machinery shall be shut-down and all energies isolated and dissipated prior to performing maintenance activities; company and/or owner lockout/tagout procedures shall be implemented. • De-energize and lockout electrical circuits whenever possible. • Refer to Electrical and Control System Installation AHA for lockout-tagout SOP. <p>Intrusive (underground) work:</p> <ul style="list-style-type: none"> • Locate and mark underground utilities prior to commencing intrusive work (i.e. trenching and excavating). • Complete Arrowhead's Utility Clearance Form. • Refer to Trenching and Excavation AHA for further details. <p>Heavy construction equipment:</p> <ul style="list-style-type: none"> • Only trained/qualified personnel shall be permitted to operate heavy construction / earthmoving equipment. • Backup alarms must be operational. • Wear safety belts. • Unless the operator gives an "all clear" signal, ground personnel shall not be permitted to approach heavy construction equipment in operation.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction ActivitiesAnalyzed by/date: S. Siegwald, CIH 07-02-14

		<ul style="list-style-type: none">• Ground personnel shall not position themselves between heavy construction equipment and a stationary object.• Ground personnel working near heavy construction equipment shall wear high visibility vests.• Spotters shall assist trucks when backing is necessary.• Rigging shall be inspected before each use.• Rigging found to be unsafe shall be taken out of service and tagged accordingly.• Inspect equipment daily (see checklist items below; also, refer to Arrowhead's Heavy Equipment Initial Inspection Checklist and Daily Inspection Checklist).• Equipment found to be defective shall be taken out of service and tagged accordingly. <p>Heavy machinery:</p> <ul style="list-style-type: none">• Keep loose clothing and hair away from moving parts of heavy machinery, and avoid wearing jewelry.• Operate machinery in accordance with the manufacturer's instructions and recommendations, as presented in equipment-specific O&M manuals.• Shut down and lock out machinery to prevent operation while repairs, adjustments, or preventative maintenance tasks are being performed.• No guard, safety appliance, or device will be removed from machinery, or made ineffective except while performing repairs, preventative maintenance, or adjustments, and then only after the power has been shut off; all guards and devices will be replaced immediately after completion of the work and before power is restored.• Machinery shall be inspected regularly to check for unusual noises, loose connections, vibrations, misalignment, etc. that may be indicative of malfunction. <p>Cold stress:</p> <ul style="list-style-type: none">• Minimize wind chill by shielding the work area or providing employees an outer wind breaking layer of clothing.• Protect extremities (i.e., fingers, ears, toes, and nose) from extreme cold by protective clothing.• Employees performing light work and whose clothing may become wet shall wear an outer layer of clothing that is impermeable to water.• Employees performing moderate to heavy work and whose clothing may become
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction Activities

Analyzed by/date: S. Siegwald, CIH 07-02-14

		<p>wet shall wear an outer layer of clothing that is water repellent.</p> <ul style="list-style-type: none"> Outer garments shall provide for ventilation to prevent wetting of inner clothing by sweat. If clothing is wet, the employee shall change into dry clothes before entering a cold environment. Workers shall change socks and removable felt insoles at regular daily intervals or use vapor barrier boots. Metal handles of tools and control bars will be covered by thermal insulating materials when temperatures fall below 30 °F.
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EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> Various lifts (i.e. forklift) and ladders Small construction equipment and power tools Generator Personal protective equipment (PPE) Leather gloves High visibility vests Safety glasses with side shields Hard hats Steel-toed footwear Hearing protection as needed Air monitoring – <u>aerosol monitor</u> 	<ul style="list-style-type: none"> Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) Inspect hand and power tools prior to use (see checklist items below) Inspect ladders prior to use Inspect PPE prior to use Inspect electrical cords for damage and presence of grounding conductor Inspect/mark areas of intrusive work for the presence of underground utility lines; complete Utility Clearance Form) Inspect heavy construction equipment upon receipt (see Heavy Equipment Initial Inspection Checklist) Inspect heavy equipment daily (see checklist items below; also, see Heavy Equipment Daily Inspection Checklist) Inspect conditions associated with trenches/excavations daily (see Trench / Excavation Checklist) 	<ul style="list-style-type: none"> Attend site safety orientation at the start of the project. Attend daily tailgate safety meetings prior to commencing work. Review the contents of this AHA. Review Emergency Response Plan, including facility-specific evaluation routes and location of severe weather shelter areas. Review hazard communication requirements, including applicable MSDSs. Electrical work – requires qualified personnel with verifiable credentials and knowledge of applicable code requirements. Intrusive Activities / Dig Permit Lockout / Tagout – follow procedures for locking out electrical power and underground utility lines

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction Activities

Analyzed by/date: S. Siegwald, CIH 07-02-14

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Material Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are heat stress monitoring instruments (i.e. thermometers) available and ready for use?
19. Are sanitation facilities (i.e. hand wash) and supplies available on site?
20. Are toilet facilities clean?

Inspection Items for Hand and Power Tools

1. All tools operated according to manufacturer's instructions and design limitations.
2. All hand and power tools maintained in a safe condition and tested before use.
3. Tools are tested daily to assure safety devices are operating properly.
4. Defective tools are tagged and removed from service until repaired.
5. PPE is selected and used according to tool-specific hazards anticipated.
6. Power tools are not carried or lowered by their cord or hose.
7. Power operated tools designed to accommodate guards have guards installed.
8. Guards are provided at point of operation, nip points, rotating parts, etc.
9. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.
10. Tools are stored properly.

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

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Activity: General Construction Activities

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11. Cordless tools and recharging units both conform to electrical standards and specifications.
12. Knife or blade hand tools are used with the proper precautions.
13. Damaged tools are removed from service until repaired.
14. Floor and bench-mounted grinders are provided with properly positioned work rests.
15. Electric tools are approved double insulated or grounded and used according to SOP HS-23.
16. Electric tools are used with a GFCI.
17. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.
18. Wrenches are not used when jaws are sprung to the point of slippage.
19. Impact tools are kept free of mushroomed heads.
20. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool.

Inspection Items for Heavy Construction Equipment

1. Personnel maintaining safe distance from operating equipment
2. Positioning personnel in close proximity to operating equipment is avoided
3. Personnel wearing high-visibility and/or reflective vests when close to operating equipment
4. Personnel approach operating equipment safely
5. Personnel riding only in seats of equipment cab and using seat belts
6. Personnel not positioned under elevated portions of equipment
7. Personnel not positioned under hoisted loads
8. Personnel not hoisted by equipment
9. Personnel do not approach equipment that has become electrically energized
10. Personnel wearing appropriate PPE
11. Only qualified and authorized personnel operating equipment
12. Daily safety briefing/meeting conducted with equipment operators
13. Daily inspection of equipment conducted and documented
14. Modifications and attachments used approved by equipment manufacturer
15. Backup alarm operational; or, spotter used when backing equipment
16. Operational horn provided on bi-directional equipment
17. Seat belts are provided and used
18. Rollover protective structures (ROPS) provided
19. Braking system capable of stopping full payload
20. Headlights and taillights operable when additional light required
21. Brake lights in operable condition
22. Cab glass provides no visible distortion to the operator

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction Activities

Analyzed by/date: S. Siegwald, CIH 07-02-14

23. All machine guards are in place
24. Hauling equipment (dump trucks) provided with cab shield or canopy
25. Dump truck beds provided with positive means of support during maintenance or inspection
26. Dump truck operating levers provided with latch to prevent accidental dumping
27. Equipment position on firm/level surface, outriggers used
28. Location of underground utilities identified
29. Safe clearance distance maintained while working under overhead power lines
30. Safe distance is maintained while traveling under power lines
31. Warning system used to remind operator of excavation edge
32. Unattended equipment visibly marked at night
33. Tools lowered/parking brake set when not in use, wheels chocked when parked on incline
34. Equipment operated on safe roadways and grades
35. Equipment operated at safe speed
36. Operators maintain unobstructed view of travel path
37. Equipment not operated during inclement weather, lightning storms
38. Equipment started and moved safely
39. Operators keep body parts inside cab during operation
40. Vehicle occupants in safe position while loading/unloading
41. Signal person visible to operator when required
42. Equipment used for hoisting done according to equipment manufacturer specifications
43. Lifting and hauling capacities are not exceeded
44. Defective components repaired immediately
45. Suspended equipment or attachments supported prior to work under or between
46. Lockout/tagout procedures used prior to maintenance
47. Tires on split rims removed using safety tire rack or cage
48. Good housekeeping maintained on and around equipment

Arrowhead Contracting, Inc. Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Construction Activities

Analyzed by/date: S. Siegwald, CIH 07-02-14

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

[illegible]

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

ACTIVITIES	POTENTIAL HAZARDS	RECOMMENDED SAFE WORK PRACTICES & CONTROLS
<p>General earthwork activities, including:</p> <ul style="list-style-type: none"> • Clearing and grubbing • Site grading • Site restoration • Reseeding 	<ul style="list-style-type: none"> • Overhead power lines • Intrusive activities • Heavy construction equipment • Weather • Fire • Moving/operating parts and small equipment • Noise • Hazardous atmospheres (general) • Dust • Slips, trips, and falls • Heat stress 	<p>General:</p> <ul style="list-style-type: none"> • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear steel-toed footwear. • Wear high-visibility construction vests. • Wear hearing protection as necessary in vicinity of loud equipment. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking shall only be permitted in approved areas. <p>Overhead power lines:</p> <ul style="list-style-type: none"> • Equipment operators must remain aware of overhead power lines and maintain safe clearances - use spotters when necessary. • A site layout plan shall be completed prior to mobilizing heavy equipment. The plan shall identify all overhead and underground hazards. • In accordance with OSHA standards (29 CFR 1926.550 and 1910.33), a minimum clearance of 10 feet must be maintained between mechanical equipment and energized overhead power lines. This clearance distance must be increased by 4 inches for every 10 kV over 50 kV. If it necessary to approach closer than 10 feet from a power line, one of the two following options will be implemented in accordance with the OSHA standard: (1) the line will be will be de-energized and

Arrowhead Contracting, Inc.
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		<p>grounded, or (2) an insulating barrier will be erected to prevent contact with the line. The barrier must be rated for the voltage of the line to be guarded. These options, if needed, will be implemented by the applicable utility company.</p> <ul style="list-style-type: none">• During operations near overhead power lines, one person involved in the operation (or the SSHO) will be assigned the duty of “observer” to visually monitor the operation and provide timely warning to equipment operators in the event the minimum clearance distance is violated. In accordance with OSHA standards, the observer will be positioned “so as to be able to visually monitor the clearance between the equipment and power lines.” The observer cannot be assigned other duties that would interfere with the ability to provide safety oversight and time warnings. <p>Intrusive activities: Before any intrusive activity begins, positive steps shall be taken to determine the locations of underground utilities. Personnel shall always be alert for marking tape, wires, pipes, previously disturbed soils, crushed stone or sand bedding/backfill, discolored soil, and other indications of the presence of buried utility lines. The following procedure shall be followed to identify the locations of buried utilities prior to commencing intrusive activities. Intrusive activities shall not begin until the SSHO and Site Supervisor have signed off on the Utility Clearance Form and have issued an Intrusive Activities Permit. Both of these forms are provided in Appendix A.</p> <ul style="list-style-type: none">• The SSHO shall contact the utility locating hot to notify them of intent to initiate intrusive activity at the given property location. This notification is to be made a minimum of two working days prior to the initiation of intrusive activity.• The SSHO shall contact the utility companies or other responsible authorities to assist in locating and marking the locations of the underground utilities.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

		<ul style="list-style-type: none">• The SSHO will ensure that underground utilities have been located and marked on the ground (using stakes, flags, and/or spray paint).• The SSHO shall document utility clearances on the Utility Clearance Form (Appendix A).• Once the clearance process is completed, the SSHO will issue an Intrusive Activities Permit (Appendix A). The signatures of the SSHO and Site Supervisor shall be obtained on the Clearance Permit before beginning intrusive activities.• A safety meeting shall be held by all personnel involved in intrusive activities prior to initiating work. <p>Heavy construction equipment:</p> <ul style="list-style-type: none">• Only trained/qualified personnel shall be permitted to operate heavy construction / earthmoving equipment.• Backup alarms must be operational.• Wear safety belts.• Unless the operator gives an “all clear” signal, ground personnel shall not be permitted to approach heavy construction equipment in operation.• Ground personnel shall not position themselves between heavy construction equipment and a stationary object.• Ground personnel working near heavy construction equipment shall wear high visibility vests.• Spotters shall assist trucks when backing is necessary.• Rigging shall be inspected before each use.• Rigging found to be unsafe shall be taken out of service and tagged accordingly.• Inspect equipment daily (see checklist items below; also, refer to Arrowhead’s Heavy Equipment Initial Inspection Checklist and Daily Inspection Checklist).• Equipment found to be defective shall be taken out of service and tagged accordingly.• Keep loose clothing and hair away from moving parts of heavy equipment, and avoid wearing jewelry.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

		<ul style="list-style-type: none">• Operate equipment in accordance with the manufacturer's instructions and recommendations, as presented in equipment-specific O&M manuals.• Shut down and lock out heavy equipment to prevent operation while repairs, adjustments, or preventative maintenance tasks are being performed.• No guard or device will be removed from machinery, or made ineffective except while performing repairs, preventative maintenance, or adjustments, and then only after the power has been shut off; all guards and devices will be replaced immediately after completion of the work and before power is restored.• Equipment shall be inspected regularly to check for unusual noises, loose connections, vibrations, misalignment, etc. that may be indicative of malfunction.• All components of heavy equipment that have a direct bearing on the safety of the operation shall be inspected at the beginning of each shift and when possible, observed during operation.• Equipment shall not be used if it is not in a safe operating condition.• A copy of the equipment operating manual shall be available at the job site. <p>Weather: Weather conditions shall be monitored. Operations shall cease during high wind or electrical storms or when electrical storms are imminent.</p> <p>Fire: Smoking will only be permitted in designated areas. Equipment will not be parked in tall grass areas. Fire extinguisher shall be provided.</p> <p>Small equipment and power tools: Hand and power tools shall be used, inspected, and maintained in accordance with the manufacturer's instructions and recommendations</p>
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Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Superfund Site

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Prepared by: Scott Siegwald, CIH, 07-02-14

		<p>and will be used only for the purpose for which designed. The following requirements shall be followed:</p> <ul style="list-style-type: none">• The tool housing will be checked to be sure it is in good condition (i.e., free of cracks and defects).• If provided, trigger locks (to prevent accidental activation) will be checked for proper function prior to using the tool.• Tools designed to accommodate guards will be equipped with the guards when in use.• Reciprocating, rotating, and moving parts of equipment shall be guarded whenever possible if exposed to contact by workers.• Moveable guards shall operate freely.• Tools shall be inspected to ascertain safe operating condition and are to be kept clean and free of accumulated dirt.• Electric power tools and extension cords shall be used with ground fault circuit interrupter (GFCI).• If the tool is not three-wire ground protected, it will be double-insulated.• Portable power cords will be designated as hard usage or extra hard usage and shall not be used if damaged, patched, oil-soaked, worn, or frayed.• For pneumatic power tools, compressed air hoses will be in good condition (no visible cracks, bubbles, or kinks) and hose connections shall be secured such that there are no noticeable air leaks.• Hydraulic tools will be checked to be sure there is no fluid leakage, hydraulic lines are in good condition (no visible cracks, bubbles, or kinks), and connections are secure.• The motor, muffler, spark plugs, and other components of gasoline-powered tools will be checked to be sure they are in good condition. The tools will also be checked for signs of fuel leakage around the gasoline tank or fuel line.• Personnel shall be aware of pinch-point hazards and work in a manner to prevent injuries. Hands shall be kept out of areas
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Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

		<p>that may present a pinching hazard and personnel shall not position themselves between equipment.</p> <ul style="list-style-type: none">• Construction crew members shall not wear loose clothing or jewelry.• The operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment prior to starting or engaging equipment.• Personnel shall be aware of and avoid hot surfaces from heat generated from engine and friction. <p>Noise: Personnel shall wear hearing protection to reduce exposures to below the OSHA limits.</p> <p>Hazardous Atmospheres (general) - Air monitoring, as described in the SSHP and shall be performed in areas where there is the possibility of elevated concentrations of toxic chemicals, flammable vapors, or oxygen-deficient atmospheres. Personnel shall immediately notify the Site Safety and Health Officer (SSHO) if odors are detected.</p> <p>Dust: Personnel shall avoid working in elevated dust environments. Control measures shall include:</p> <ul style="list-style-type: none">• Real-time air monitoring for comparison to PEL for nuisance dust• Minimizing material free-fall from excavation equipment (e.g., loaders and excavators) a• Removing soil from exterior surfaces of dump trucks• Covering and securing loads on dump trucks using tarps• Water spraying exposed soil during excavation, taking care to avoid overspraying• Water spraying loads when loading-out dump trucks, taking care to avoid overspraying• Water spraying contaminated material stockpiles (as necessary)• Covering stockpiles with plastic sheeting
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Activity Hazard Analysis (AHA)

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Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

		<ul style="list-style-type: none"> • Water spraying haul roads • Suspending or restricting work activities when dust levels become elevated or when the wind speed is excessive • Positioning personnel upwind <p>Slips, trips, falls: Keep work areas clear and maintain housekeeping. Personnel shall not jump from equipment or elevated surfaces. Personnel shall avoid walking on rough or slippery terrain. Personnel working at heights greater than six feet shall utilize fall protection (full body harness with lanyard).</p> <p>Heat stress:</p> <ul style="list-style-type: none"> • Acclimatize workers to hot working conditions. • Provide plenty of liquids to replace the body fluids lost by perspiration. • Provide personal cooling devices. • Conduct strenuous field operations in the early morning if possible. • Rotate personnel to various job duties. • Establish adequate work/rest cycles. • Monitor heart rate and/or body temperature as appropriate.
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EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Excavator • Compactor • Other compaction equipment, as needed (pad foot compactor, walk-behind pad foot roller, walk behind plate compactor) • Water truck 	<ul style="list-style-type: none"> • Intrusive activities clearance request form completed • Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) • Inspect hand and power tools prior to use (see checklist items below) 	<ul style="list-style-type: none"> • Attend site safety orientation at the start of the project • Attend daily tailgate safety meetings prior to commencing work. • Review Emergency Response Plan, including facility-specific evaluation routes and location

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<ul style="list-style-type: none"> • Trash pump • Personal protective equipment (PPE) listed below • Leather gloves • Hard hats • Steel-toed footwear • Fire extinguisher • High visibility vests • Hand tools • Air monitoring – <u>aerosol monitor</u> • Hearing protection 	<ul style="list-style-type: none"> • Inspect PPE prior to use • Inspect/mark areas of intrusive work for the presence of underground utility lines; complete Utility Clearance Form) • Inspect heavy construction equipment upon receipt (see Heavy Equipment Initial Inspection Checklist) • Inspect heavy equipment daily (see checklist items below; also, see Heavy Equipment Daily Inspection Checklist) • Inspect conditions associated with trenches/excavations daily (see Trench / Excavation Checklist) 	<p>of severe weather shelter areas.</p> <ul style="list-style-type: none"> • Review hazard communication requirements, including applicable MSDSs. • Heavy equipment operators shall be properly trained, certified, and/or licensed for the specific piece of equipment as required
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General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Material Safety Data Sheets available on site for operational chemicals?
16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?

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Activity Hazard Analysis (AHA)

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Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

- 18. Are heat stress monitoring instruments (i.e. thermometers) available and ready for use?
- 19. Are sanitation facilities (i.e. hand wash) and supplies available on site?
- 20. Are toilet facilities clean?

Inspection Items for Hand and Power Tools

- 1. All tools operated according to manufacturer's instructions and design limitations.
- 2. All hand and power tools maintained in a safe condition and tested before use.
- 3. Tools are tested daily to assure safety devices are operating properly.
- 4. Defective tools are tagged and removed from service until repaired.
- 5. PPE is selected and used according to tool-specific hazards anticipated.
- 6. Power tools are not carried or lowered by their cord or hose.
- 7. Power operated tools designed to accommodate guards have guards installed.
- 8. Guards are provided at point of operation, nip points, rotating parts, etc.
- 9. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.
- 10. Tools are stored properly.
- 11. Cordless tools and recharging units both conform to electrical standards and specifications.
- 12. Knife or blade hand tools are used with the proper precautions.
- 13. Damaged tools are removed from service until repaired.
- 14. Floor and bench-mounted grinders are provided with properly positioned work rests.
- 15. Electric tools are approved double insulated or grounded and used according to SOP HS-23.
- 16. Electric tools are used with a GFCI.
- 17. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.
- 18. Wrenches are not used when jaws are sprung to the point of slippage.
- 19. Impact tools are kept free of mushroomed heads.
- 20. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool.

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

Inspection Items for Heavy Construction Equipment

1. Personnel maintaining safe distance from operating equipment
2. Positioning personnel in close proximity to operating equipment is avoided
3. Personnel wearing high-visibility and/or reflective vests when close to operating equipment
4. Personnel approach operating equipment safely
5. Personnel riding only in seats of equipment cab and using seat belts
6. Personnel not positioned under elevated portions of equipment
7. Personnel not positioned under hoisted loads
8. Personnel not hoisted by equipment
9. Personnel do not approach equipment that has become electrically energized
10. Personnel wearing appropriate PPE
11. Only qualified and authorized personnel operating equipment
12. Daily safety briefing/meeting conducted with equipment operators
13. Daily inspection of equipment conducted and documented
14. Modifications and attachments used approved by equipment manufacturer
15. Backup alarm operational; or, spotter used when backing equipment
16. Operational horn provided on bi-directional equipment
17. Seat belts are provided and used
18. Rollover protective structures (ROPS) provided
19. Braking system capable of stopping full payload
20. Headlights and taillights operable when additional light required
21. Brake lights in operable condition
22. Cab glass provides no visible distortion to the operator
23. All machine guards are in place
24. Hauling equipment (dump trucks) provided with cab shield or canopy
25. Dump truck beds provided with positive means of support during maintenance or inspection
26. Dump truck operating levers provided with latch to prevent accidental dumping
27. Equipment position on firm/level surface, outriggers used
28. Location of underground utilities identified
29. Safe clearance distance maintained while working under overhead power lines
30. Safe distance is maintained while traveling under power lines
31. Warning system used to remind operator of excavation edge
32. Unattended equipment visibly marked at night
33. Tools lowered/parking brake set when not in use, wheels chocked when parked on incline
34. Equipment operated on safe roadways and grades

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Earthwork, Grading, and Restoration

Prepared by: Scott Siegwald, CIH, 07-02-14

- 35. Equipment operated at safe speed
- 36. Operators maintain unobstructed view of travel path
- 37. Equipment not operated during inclement weather, lightning storms
- 38. Equipment started and moved safely
- 39. Operators keep body parts inside cab during operation
- 40. Vehicle occupants in safe position while loading/unloading
- 41. Signal person visible to operator when required
- 42. Equipment used for hoisting done according to equipment manufacturer specifications
- 43. Lifting and hauling capacities are not exceeded
- 44. Defective components repaired immediately
- 45. Suspended equipment or attachments supported prior to work under or between
- 46. Lockout/tagout procedures used prior to maintenance
- 47. Tires on split rims removed using safety tire rack or cage
- 48. Good housekeeping maintained on and around equipment

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

By signing below, I am confirming that I have reviewed the contents of this AHA, including the description of the relevant hazards, safe work practices and hazard control measures, recommended personal protective equipment, inspection requirements, and training requirements. As such, I understand and concur with the AHA and will comply with the health and safety standards and protocols referenced herein. I further understand that work activities must immediately be discontinued if an imminent danger exists, any change in the scope of work occurs that could affect worker health and safety, new hazards are identified, existing hazards cannot be adequately controlled, and/or any change in work conditions occurs that could adversely impact worker health and safety.

Printed Name	Signature	Date

Subcontract No. 3320-048-001-CN

Prepared by: Scott Siegwald, CIH, 07-02-14

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Arrowhead Contracting, Inc. Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Site Work, Surveying, & Inspection Activities

Prepared by: Scott Siegwald, CIH, 07-02-14

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
<p>General site work, set-up, preparation, land surveying and administration activities, including:</p> <ul style="list-style-type: none"> • Equipment delivery, receipt, and inspection • Layout site work zones • Land surveying - construction layout survey • Utility clearances • Installation and maintenance of site controls including site controls • Prepare equipment lay-down area • Prepare equipment decontamination area • Site inspection and oversight activities during construction 	<ul style="list-style-type: none"> • Heavy lifting • Intrusive activities • Vehicular traffic • Chemical exposure (general) • Fire • Slips, trips, falls • Hand injuries • Insect/animal bites • Heat stress • Miscellaneous site activity 	<p>General:</p> <ul style="list-style-type: none"> • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear steel-toed footwear. • Wear high-visibility construction vests. • Wear hearing protection as necessary when ambient noise levels become elevated. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside site office trailer. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklists contained in SSHP). • Smoking shall only be permitted in approved areas. <p>Heavy Lifting: No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.</p> <p>Intrusive Activities: Follow procedure for Intrusive Activities Permit. Underground utilities shall be located and marked prior to driving stakes, posts, benchmarks, etc.</p> <p>Vehicular Traffic: Personnel working on or near roads shall wear high visibility vests and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic.</p>

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Site Work, Surveying, & Inspection Activities

Prepared by: Scott Siegwald, CIH, 07-02-14

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<p>Implement traffic control provisions – i.e. barricades, signs, lane closures, flagmen, etc. – as necessary for the given work area.</p> <p>Chemical Exposure (General): Physical contact with contaminated media or hazardous chemicals shall be avoided. Personal protective equipment use is required when contact is possible/probable. Personnel who sustain skin contact shall immediately wash the affected area with soap and water (eyes should be irrigated for 15 minutes with potable water) and report the incident to the SSHO.</p> <p><i>Refer to other AHAs for health and safety requirements associated with exposure to contaminated media / contaminants of concern (COCs).</i></p> <p>Fire: Smoking shall not be permitted in regulated areas. Fire extinguishers shall be available on-site.</p> <p>Slips, trips, and falls:</p> <ul style="list-style-type: none"> • Implement good housekeeping practices – keep the area free of materials, scrap, and debris. • Electrical extension cords and electrical wiring shall be kept clear of walking and working areas and/or covered or otherwise secured. • Clean up spills immediately. • Provide adequate illumination. • Do not jump from equipment or elevated surfaces.

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Site Work, Surveying, & Inspection Activities

Prepared by: Scott Siegwald, CIH, 07-02-14

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		<p>Hand Injuries: Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.</p> <p>Insects / Animal Bites: Review injury potential with workers. Wear PPE and tape joints to keep insects away from the skin. Use protective insect repellents containing DEET to prevent insect bites. Check limbs/body for insects/ insect bites before showering. Notify SSHO of flu-like symptoms.</p> <p>Contact Dermatitis: Wear long-sleeved shirts/trousers or Tyvek coveralls to avoid skin contact with plants or other skin irritants. Identify and review poisonous plants with workers. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (Visqueen) where survey position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy.</p> <p>Heat stress:</p> <ul style="list-style-type: none"> • Acclimatize workers to hot working conditions. • Provide plenty of liquids to replace the body fluids lost by perspiration. • Provide personal cooling devices. • Conduct strenuous field operations in the early morning if possible. • Rotate personnel to various job duties. • Establish adequate work/rest cycles. • Monitor heart rate and/or body temperature as appropriate.

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: General Site Work, Surveying, & Inspection Activities

Prepared by: Scott Siegwald, CIH, 07-02-14

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		Miscellaneous Site Activity: When possible, personnel shall avoid areas that have hazardous activities in progress. When access must be gained in busy areas, the foremen of the activities in the area shall be notified prior to surveying in the area. High visibility vests shall be worn when working in areas with high vehicular or heavy equipment traffic.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
First aid kit Land surveying equipment Fire extinguishers PPE as listed below Leather gloves Safety glasses with side shields Hard hats Steel-toed footwear Hearing protection as needed High visibility vests Insect repellent	Intrusive activities permit Survey areas for poisonous plants, insects, and animals	<ul style="list-style-type: none"> Attend site safety orientation at the start of the project. Attend daily tailgate safety meetings prior to commencing work. Review the contents of this AHA Review Emergency Response Plan, including facility-specific evaluation routes and location of severe weather shelter areas. Review hazard communication requirements, including applicable MSDSs.

Subcontract No. 3320-048-001-CN

Prepared by: Scott Siegwald, CIH, 07-02-14

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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment Operations

Analyzed by/date: S. Siegwald, CIH 07-02-14

ACTIVITIES	POTENTIAL HAZARDS	RECOMMENDED SAFE WORK PRACTICES & CONTROLS
Start-up, operations and maintenance (O&M) of treatment system.	<ul style="list-style-type: none"> • Eye hazards • Noise • Chemical exposure • Slips, trips, and falls • Small hand and power tools • Overhead hazards • Lifting / ergonomics • Material handling • Forklift • Hazardous energy control • Process equipment operations 	<p>General:</p> <ul style="list-style-type: none"> • Wear protective leather gloves as necessary. • Wear safety glasses. • Wear hard hats. • Wear steel-toed footwear. • Wear hearing protection as necessary in vicinity of air compressor. • Ensure that fire extinguishers are available to personnel. • Provide fire extinguishers (at least 10# ABC) inside the cabs of heavy construction equipment. • Inspect the jobsite daily for the presence of required PPE and safety equipment (see checklist items below). • Smoking shall only be permitted in approved areas. <p>Eye hazards:</p> <ul style="list-style-type: none"> • Wear safety glasses with side shields at all times during construction/field activities. • Don splash shields or goggles as necessary for tasks with potential splash hazards (i.e. when disconnecting formerly-pressurized water conveyance lines) <p>Noise:</p> <ul style="list-style-type: none"> • Wear hearing protection while working near air compressors. • Implement engineering controls to reduce noise levels as appropriate. <p>Chemical exposure (COCs contained in groundwater):</p> <ul style="list-style-type: none"> • Don proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of COCs (<u>CVOC's</u>) before starting work • Review chemical hazards with personnel before work begins • Conduct continuous air monitoring per SSHP • Wear chemical-resistant gloves as needed for contact with contaminated groundwater

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment Operations

Analyzed by/date: S. Siegwald, CIH 07-02-14

		<ul style="list-style-type: none"> • Ensure adequate ventilation <p>Slips, trips, and falls:</p> <ul style="list-style-type: none"> • Implement good housekeeping practices – keep the area free of materials, scrap, and debris. • To the maximum extent possible, air lines shall be kept clear of walking and working areas and/or covered or otherwise secured. • Clean up spills immediately. • Provide adequate illumination. • Do not jump from equipment or elevated surfaces. <p>Small hand and power tools:</p> <ul style="list-style-type: none"> • Wear protective gloves as necessary. • Use GFCIs for all electrical-powered tools. • Maintain manufacturer safeguards on power tools. • Extension cords shall be inspected before use, protected from damage, and kept out of wet areas. • Inspect equipment daily (see checklist items below). • Equipment found to be defective shall be taken out of service and tagged accordingly. <p>Overhead hazards:</p> <ul style="list-style-type: none"> • Wear hard hats. • Evaluate overhead hazards (including power lines) prior to allowing heavy construction equipment onto the site. • Areas with overhead hazards shall be barricaded as necessary to prevent heavy construction equipment from approaching. • Maintain a minimum distance of 10 feet from overhead power lines; provide spotters as necessary, or have the lines shielded or de-energized by the local power utility. • Ground personnel shall never stand beneath suspended loads. <p>Lifting / ergonomics:</p> <ul style="list-style-type: none"> • Avoid awkward postures, bending, twisting, and repetitive motions to the maximum extent practical.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment OperationsAnalyzed by/date: S. Siegwald, CIH 07-02-14

		<ul style="list-style-type: none">• Personnel shall not individually lift a load exceeding 60 pounds; use multiple personnel or mechanical lifting devices instead.• Use handling devices (i.e. dollies, carts, hand trucks) whenever feasible.• Use material handling equipment (i.e. forklifts, hoists) whenever feasible.• For manual lifts, bend at the knees to grasp the load, lift gradually using your legs, and keep the load close to your body; do not twist the body during the lift; if you have to turn, turn with your feet, not your trunk.• Warm up for a lift by bending, stretching, and turning. <p>Material handling:</p> <ul style="list-style-type: none">• Be aware of sharp and jagged edges.• Be aware of and avoid pinch / nip points.• Be aware of slippery gripping surfaces.• Wear protective leather gloves as necessary. <p>Forklift:</p> <ul style="list-style-type: none">• Only qualified personnel shall be permitted to operate forklift. All equipment shall be operated at safe speeds and in a safe manner.• Operators shall wear safety belts and hearing protection.• Ground personnel shall not position themselves between equipment and stationary objects and only approach equipment after a signal from the operator.• Operators must remain aware of overhead power lines and maintain safe clearances - use spotters when necessary. Personnel shall never stand under suspended loads.• Keep work areas clear and maintain housekeeping. Personnel shall not jump from equipment or elevated surfaces.• Ground personnel working near heavy construction equipment shall wear high visibility vests.• Spotters shall assist trucks when backing is necessary.• Rigging shall be inspected before each use.• Rigging found to be unsafe shall be taken out of service and tagged accordingly.• Inspect equipment daily (see checklist items below; also, refer to Arrowhead's Heavy Equipment Initial Inspection Checklist and Daily Inspection Checklist).• Equipment found to be defective shall be taken out of service and tagged
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment OperationsAnalyzed by/date: S. Siegwald, CIH 07-02-14

		<p>accordingly.</p> <p>Loading safety guidelines:</p> <ul style="list-style-type: none">• Make sure the load is stable before it is moved.• Move the forklift into position. Be sure the forks are adjusted to the width of the load.• Drive forward until the forks are positioned all the way into the load. Brace the load against the fork carriage.• Lift the load slightly and back out.• Tilt the mast back before you travel with the load. Travel with the load as close to the floor as possible. <p>Unloading safety guidelines:</p> <ul style="list-style-type: none">• Position the load directly over the destination.• Straighten the mast.• Slowly lower the load.• Back away slowly and make sure the forks are clear of the load before turning. <p>Hazardous energy control:</p> <ul style="list-style-type: none">• All equipment and machinery shall be shut-down and all energies (<u>including pneumatic pressure and pressurized water lines</u>) isolated and dissipated prior to performing maintenance activities; company and/or owner lockout/tagout procedures shall be implemented.• Air compressors shall be designed, inspected, and tested in accordance with American Society of Mechanical Engineers (ASME) standards.• Air compressors and hoses shall be inspected before use, operated, and maintained by designated, qualified personnel.• Air compressors shall be equipped with a pressure gauge and relief valve, and only be operated at design pressures. <p>Process equipment operations:</p> <ul style="list-style-type: none">• Keep loose clothing and hair away from moving parts of heavy machinery, and avoid wearing jewelry.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment OperationsAnalyzed by/date: S. Siegwald, CIH 07-02-14

		<ul style="list-style-type: none">• Operate machinery in accordance with the manufacturer's instructions and recommendations, as presented in equipment-specific O&M manuals.• Shut down and lock out machinery to prevent operation while repairs, adjustments, or preventative maintenance tasks are being performed.• No guard, safety appliance, or device will be removed from machinery, or made ineffective except while performing repairs, preventative maintenance, or adjustments, and then only after the power has been shut off; all guards and devices will be replaced immediately after completion of the work and before power is restored.• Machinery shall be inspected regularly to check for unusual noises, loose connections, vibrations, misalignment, etc. that may be indicative of malfunction.• For pneumatic equipment, compressed air hoses will be in good condition (no visible cracks, bubbles, or kinks) and hose connections shall be secured such that there are no noticeable air leaks.• Diesel-powered compressor: The motor, muffler, spark plugs, and other components of gasoline-powered tools will be checked to be sure they are in good condition. The tools will also be checked for signs of fuel leakage around the gasoline tank or fuel line.• Personnel shall be aware of pinch-point hazards and work in a manner to prevent injuries. Hands shall be kept out of areas that may present a pinching hazard and personnel shall not position themselves between equipment.• The operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment prior to starting or engaging equipment.• Personnel shall be aware of and avoid hot surfaces from heat generated from engine and friction.
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Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment Operations

Analyzed by/date: S. Siegwald, CIH 07-02-14

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Forklift (as necessary) • PPE as listed below • High visibility vests • Leather gloves • Safety glasses with side shields • Hard hats • Steel-toed footwear • Hearing protection as needed • Tyvek coveralls as needed • Respiratory protection as needed • Air monitoring – <u>PID</u> 	<ul style="list-style-type: none"> • Inspect the job site daily for appropriate PPE and safety equipment (see checklist items below) • Inspect hand and power tools prior to use (see checklist items below) • Inspect PPE prior to use • Inspect pneumatic air lines for damage prior to start-up • Inspect forklift prior to use (see checklist items below) 	<ul style="list-style-type: none"> • Attend site safety orientation at the start of the project. • Attend daily tailgate safety meetings prior to commencing work. • Review the contents of this AHA. • Review Emergency Response Plan, including facility-specific evaluation routes and location of severe weather shelter areas. • Review hazard communication requirements, including applicable MSDSs. • Lockout / Tagout – follow procedures for de-energizing process equipment and pressurized lines prior to disconnecting or servicing

General Safety Equipment Inspection Checklist

1. Are adequate and serviceable fire extinguishers provided?
2. Are fire extinguishers present at assigned locations?
3. Is access to each fire extinguisher clear of obstructions?
4. Are fire extinguishers fully charged; are locking pins in place?
5. Are eye wash stations present at assigned locations?
6. Are eye wash stations filled with water and in sanitary condition?
7. Is access to each eye wash station clear of obstructions?
8. Are first aid kits present on site?
9. Does each first aid kit contain the proper items – compresses, bandages, adhesive tape, eye dressings, ice packs, gauze, etc.?
10. Are emergency spill supplies/kits available on site?
11. Have air monitoring instruments been properly calibrated?
12. Is the required PPE available on site?
13. Has the PPE been inspected for defects or damage?
14. Are flammable chemicals (not in use) stored in an approved cabinet?
15. Are Material Safety Data Sheets available on site for operational chemicals?

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment Operations

Analyzed by/date: S. Siegwald, CIH 07-02-14

16. Is a bloodborne pathogens exposure kit available on site?
17. Is cold, potable water available to employees?
18. Are heat stress monitoring instruments (i.e. thermometers) available and ready for use?
19. Are sanitation facilities (i.e. hand wash) and supplies available on site?
20. Are toilet facilities clean?

Inspection Items for Hand and Power Tools

1. All tools operated according to manufacturer's instructions and design limitations.
2. All hand and power tools maintained in a safe condition and tested before use.
3. Tools are tested daily to assure safety devices are operating properly.
4. Defective tools are tagged and removed from service until repaired.
5. PPE is selected and used according to tool-specific hazards anticipated.
6. Power tools are not carried or lowered by their cord or hose.
7. Power operated tools designed to accommodate guards have guards installed.
8. Guards are provided at point of operation, nip points, rotating parts, etc.
9. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.
10. Tools are stored properly.
11. Cordless tools and recharging units both conform to electrical standards and specifications.
12. Knife or blade hand tools are used with the proper precautions.
13. Damaged tools are removed from service until repaired.
14. Floor and bench-mounted grinders are provided with properly positioned work rests.
15. Electric tools are approved double insulated or grounded .
16. Electric tools are used with a GFCI.
17. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.
18. Wrenches are not used when jaws are sprung to the point of slippage.
19. Impact tools are kept free of mushroomed heads.
20. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool.

Arrowhead Contracting, Inc.
Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment Operations

Analyzed by/date: S. Siegwald, CIH 07-02-14

Forklift Daily Inspection Checklist

VISUAL:

Engine

Crankcase oil
Belts
Wires
Fuel line

Components

Fuel Tank
LPG tank straps
Gauges, Temperature
Gauges, Hour
Gauges, Speed
Gauges, Battery
Brake Fluid

Hydraulic Fluid
Hydraulic Lines
Tires, Wheels, Rims
Forks
Mast Chains

Body

Lights, Head
Lights, Tail
Lights, Signal
Lights, Warning
Fire Extinguisher
Seat
Seat Belt
Overhead Cage
Operating Instructions
Lifting Capacity

OPERATIONAL:

Horn
Back-Up Warning Device
Steering
Parking Brake
Service Brake
Gear Shift Lever
Transmission
Adjusted Seat
Seat Safety Switch
Mast Lift Up/Down
Mast Tilt
Mast Side/Squeeze

Arrowhead Contracting, Inc. Activity Hazard Analysis (AHA)

Remedial Construction Activities, Old Roosevelt Field Superfund Site

Subcontract No. 3320-048-001-CN

Activity: On-Site Groundwater Treatment Operations

Analyzed by/date: S. Siegwald, CIH 07-02-14

ACTIVITY HAZARD ANALYSIS ACKNOWLEDGEMENT:

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Appendix C
Material Safety Data Sheets

OSHA-Required Health And Safety Information!

This Material Safety Data Sheet (MSDS) was requested moments ago from Hercules Automated Fax Information System. Please forward it immediately to the person in charge of MSDS's, or retain it at the machine until claimed.

Section 1**MATERIAL SAFETY DATA SHEET # 93**
Hercules PVC Cement, Gray, "LOW VOC"**MATERIAL
SAFETY
INFORMATION
SERVICE**

Hercules Chemical Company Inc.
111 South Street
Passaic NJ 07055
Phone (800) 221-9330
Fax (800) 333-3456

Date Prepared: 11/4/1996 Last Reviewed: 8/27/2007

Meets OSHA 29 CFR 1910.1200

Section 2 - Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity;
Common Name(s), CAS Numbers)

OSHA PEL

ACGIH TLV

Other Limits

Upper Bound
Limit if SARA
Reportable

This MSDS is for LOW VOC Product (As shown on label) ONLY. For regular product see MSDS #60.

Tetrahydrofuran (109-99-9)	200 PPM	200 PPM	N/A	--
Methyl Ethyl Ketone (78-93-3)	200 PPM	200 PPM	N/A	--
Cyclohexanone (108-94-1)	50 PPM	20 PPM	N/A	--
Acetone (67-64-1)	750 PPM	750 PPM	N/A	--
N-Methyl Pyrrolidone (872-50-4)	None	None	N/A	15%

HMIS Hazard Rating: Health: 3 Flammability: 4 Reactivity: 1 Personal Protection: G

Section 3 - Physical/Chemical Characteristics

Boiling Point (°F):	Specific Gravity (H ₂ O = 1):	Vapor Density (Air = 1):	Vapor Pressure (mm Hg):
133 Based on first boiling component-Acetone	0.920 ± 0.03	2.0 to 2.5	190 Based on first boiling component-Acetone
Melting Point (° F):	Evaporation Rate: (Butyl Acetate = 1)	Solubility in Water:	
N/A	7-11	55% to 75%	

Appearance And Color: Gray Viscous Liquid

Odor: Ethereal & Acetone-like

Section 4 - Fire And Explosion Hazard Data

Flash Point:	Flammable Limits:	LEL:	UEL:
0-6° F (T.C.C.) (Based on Acetone)		2%	13%

Extinguishing Media: Dry chemical. Foam. Carbon dioxide

Special Firefighting Procedures:

Handle as flammable liquid. Wear self-contained breathing apparatus & chemical goggles. Water may be ineffective, but should be used to keep fire-exposed containers cool.

Unusual Fire And Explosion Hazards:

Vapor is heavier than air and travels considerable distance to source of ignition and flashback. On long standing may form peroxides which may cause violent reaction especially upon evaporation to dryness.

Continued on Next Page

Section 5 - Reactivity Data

Stability: Stable **Conditions To Avoid:** Keep in closed containers away from sparks and open flame.

Incompatibility (Materials To Avoid): Strong oxidizing materials, Lithium Aluminum Hydride, Sodium Aluminum Hydroxide, Sodium and Potassium Hydroxides.

Hazardous Decomposition: CO₂ and CO are formed. Irritating peroxide fumes form when heated to decomposition.

Hazardous Polymerization: Avoid excessive exposure to air and cationic initiators like Lewis Acids.

Section 6 - Health Hazard Data

Routes of Entry: **Inhalation** Yes/Primary **Skin** Yes/Primary **Ingestion** Yes/Secondary

Health Hazards:

Corrosive to eyes and skin irritant. Severe overexposure can cause headache, dizziness and narcosis. May cause dermatosis with prolonged repeated contact.

Carcinogenicity: **NTP** NO **IARC** NO **OSHA Regulated** NO

Signs And Symptoms of Exposure:

INGESTION: No effects of exposure expected. **INHALATION:** Will cause irritation of mucous membranes, nose, eyes & throat, coughing, difficulty of breathing. Exposure to high vapor concentration may cause headache, dizziness, nausea, narcosis. **SKIN CONTACT:** Prolonged contact causes common solvent defatting effect. **EYE CONTACT:** Vapors slightly uncomfortable, splashes irritating. Will cause painful burning or stinging of eyes and lids, watering of eyes and inflammation of conjunctiva.

Medical Conditions Generally Aggravated By Exposure:**Emergency And First Aid Procedures:**

INGESTION: Do not induce vomiting. If conscious, dilute by giving 2 glasses of water. Call a physician immediately. **INHALATION:** Remove to fresh air. If not breathing give artificial respiration preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician. **SKIN CONTACT:** Wash affected areas with soapy water. Remove contaminated clothing. **EYE CONTACT:** Immediately flush eyes with plenty of water for 15 minutes. Consult a physician.

Continued on Next Page

Section 7 - Precautions For Safe Handling And Use:**Steps To Be Taken In Case Material Is Released Or Spilled:**

Eliminate sources of ignition. Absorb with sand or inert absorbing material and dispose of with solid waste according to Federal, State and local regulations. Flush spill area with water, avoid flushing into confined areas.

Waste Disposal Method:

Incinerate in accordance with Federal, State and local regulations.

Precautions To Be Taken In Handling And Storing:

Store in cool place, well-ventilated area. Keep away from open flame and sources of ignition.

Other Precautions:

Use normal good personal hygiene.

Section 8 - Control Measures:**Respiratory Protection:**

In confined spaces or other circumstances where adequate ventilation cannot be assured use NIOSH-approved respirator, positive pressure airline mask, or self contained breathing apparatus.

Ventilation: Local Exhaust As required.

Mechanical All ventilating devices must be located so they do not provide a source of ignition.

Special When using cements in an area of limited ventilation, use a ventilation device such as a fan or air mover to maintain a safe air concentration.

Gloves: PVA gloves.

Other: N/A

Eye Protection: Chemical safety goggles.

Other Protective Clothing: Apron, boots, eye bath, safety shower.

Work/Hygienic Practices: Wash thoroughly after handling. Avoid ingestion of the cements. Do not eat or drink when using cements or in the vicinity where such cements are being used.



FACTS
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For Hercules Material Safety Data Sheets by fax anytime, day or night, just call 1-800-942-INFO (1-800-942-4636) from any Touch-Tone phone. Have your fax number ready. Checking the product label for the correct MSDS # will save time.

OSHA-Required Health And Safety Information!

This Material Safety Data Sheet (MSDS) was requested moments ago from Hercules Automated Fax Information System. Please forward it immediately to the person in charge of MSDS's, or retain it at the machine until claimed.

Section 1

MATERIAL SAFETY DATA SHEET # 118 *Hercules UnPurple Primer*

Date Prepared: 4/9/2007

Last Reviewed: 4/9/2007

Meets OSHA 29 CFR 1910.1200



**MATERIAL
SAFETY
INFORMATION
SERVICE**

Hercules Chemical Company Inc.
111 South Street
Passaic NJ 07055
Phone (800) 221-9330
Fax (800) 333-3456

Section 2 - Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity;
Common Name(s), CAS Numbers)

	OSHA PEL	ACGIH TLV	Other Limits	Upper Bound Limit if SARA Reportable
	TWA	TWA		
Tetrahydrofuran (109-99-9)	200PPM	200PPM	250 STEL	- -
Methyl Ethyl Ketone (78-93-3)	200PPM	200PPM	300 STEL	- -
Cyclohexanone (108-94-1)	50PPM	20PPM	N/A	- -
Acetone (67-64-1)	1000 PPM	500PPM	750 STEL	

HMIS Hazard Rating: Health: 3 Flammability: 4 Reactivity: 1 Personal Protection: G

Section 3 - Physical/Chemical Characteristics

Boiling Point (°F):	Specific Gravity (H2O = 1):	Vapor Density (Air = 1):	Vapor Pressure (mm Hg):
133 Based on first boiling component-Acetone	0.820 ± 0.03	2.0 to 2.5	400 @ 104° F Based on first boiling component-Acetone
Melting Point (° F)	Evaporation Rate: (Butyl Acetate = 1)	Solubility in Water:	
N/A	7-11	50% to 75%	
Appearance And Color:	Flourescent Purple Liquid		Odor: Ethereal & Acetone-like

Section 4 - Fire And Explosion Hazard Data

Flash Point:	Flammable Limits:	LEL:	UEL:
0° to -4.0° F (TCC) (Based on acetone)		2%	13.0%

Extinguishing Media: Foam/Dry chemical/CO2

Special Firefighting Procedures:

Handle as flammable liquid. Wear self-contained breathing apparatus & chemical goggles. Water may be ineffective, but should be used to keep fire-exposed containers cool.

Unusual Fire And Explosion Hazards:

Vapor is heavier than air and travels considerable distance to sources of ignition and flashback. On long standing may cause peroxides which may cause violent reaction especially upon evaporation to dryness.

Continued on Next Page

Section 5 - Reactivity Data

Stability: Stable **Conditions To Avoid:** Keep in closed containers away from sparks & open flame.

Incompatibility (Materials To Avoid): Strong oxidizing materials, Lithium Aluminum Hydride, Sodium Aluminum Hydroxide, Sodium & Potassium Hydroxides.

Hazardous Decomposition: Carbon dioxide and carbon monoxide are formed. Irritating Peroxide fumes are formed when heated to decomposition.

Hazardous Polymerization: Avoid excessive exposure to air and cationic initiators like Lewis Acids.

Section 6 - Health Hazard Data

Routes of Entry: **Inhalation** YES/Primary **Skin** YES/Primary **Ingestion** YES/Secondary

Health Hazards:

Corrosive to eyes and skin irritant. Severe overexposure can cause headache, dizziness and narcosis. May cause dermatosis and dermatitis with prolonged repeated contact.

Carcinogenicity: **NTP** NO **IARC** NO **OSHA Regulated** NO

Signs And Symptoms of Exposure:

INGESTION: No effects expected. **INHALATION:** Will cause irritation of mucous membranes, nose, eyes, & throat; coughing, difficulty of breathing. Exposure to high vapor concentration may cause headache, dizziness, nausea, narcosis. **SKIN CONTACT:** Prolonged skin contact causes common solvent defatting effect. **EYE CONTACT:** Vapors slightly uncomfortable. Splashes irritating. Will cause painful burning or stinging of eyes & lids, watering of eyes and conjunctiva.

Medical Conditions Generally Aggravated By Exposure:

No data found

Emergency And First Aid Procedures:

INGESTION: DO NOT INDUCE VOMITING. If conscious, dilute by giving 2 glasses of water. Call a physician immediately. **INHALATION:** Remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth resuscitation. If breathing is difficult, give oxygen. Call a physician. **SKIN CONTACT:** Wash affected area with soapy water. Remove contaminated clothing. **EYE CONTACT:** Immediately flush eyes with plenty of water for 15 minutes. Consult a physician.

Continued on Next Page

Section 7 - Precautions For Safe Handling And Use:**Steps To Be Taken In Case Material Is Released Or Spilled:**

Eliminate sources of ignition. Absorb with sand or inert absorbing material. Dispose of with solid waste in accordance with all regulations. Flush spill area with water. Avoid flushing into confined areas.

Waste Disposal Method:

Incinerate in accordance with federal, state and local regulations.

Precautions To Be Taken In Handling And Storing:

Store in cool, well-ventilated area. Keep away from open flame and sources of ignition.

Other Precautions:

Use normal good personal hygiene.

Section 8 - Control Measures:**Respiratory Protection:**

In confined spaces or other circumstances where adequate ventilation cannot be assured use NIOSH-approved respirator, positive pressure airline mask, or self contained breathing apparatus.

Ventilation: **Local Exhaust** As required
 Mechanical All ventilating devices must be located so they do not provide a source of ignition.

Special When using cements in an area of limited ventilation, use a ventilation device such as a fan or air mover to maintain a safe air concentration.

Gloves: PVA gloves

Other: N/A

Eye Protection: Chemical Safety goggles.

Other Protective Clothing: Apron, boots, eye bath, safety shower

Work/Hygienic Practices Wash thoroughly after handling. Avoid ingestion of the cements. do not eat or drink when using cements or in the vicinity where such cements are being used.



FACTS
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AST!

For Hercules Material Safety Data Sheets by fax anytime, day or night, just call 1-800-942-INFO (1-800-942-4636) from any Touch-Tone phone. Have your fax number ready. Checking the product label for the correct MSDS # will save time.

JL SHIELY -- 6 X 20, KITTY LITTER LBS 20, MINERAL FILLER -- 6810-00F023728

===== Product Identification =====

Product ID:6 X 20, KITTY LITTER LBS 20, MINERAL FILLER

MSDS Date:05/14/1987

FSC:6810

NIIN:00F023728

MSDS Number: BNJJG

=== Responsible Party ===

Company Name:JL SHIELY

Address:1101 SNELLING AVE N

City:ST PAUL

State:MN

ZIP:55108

Country:US

Info Phone Num:(612) 646-2129

Emergency Phone Num:(612) 646-2129

CAGE:JLSHI

=== Contractor Identification ===

Company Name:JL SHIELY

Address:1101 SNELLING AVE N

City:ST PAUL

State:MN

ZIP:55108

Country:US

Phone:(612) 646-2129

CAGE:JLSHI

===== Composition/Information on Ingredients =====

Ingred Name:CALCIUM CARBONATE, DOMOLITE, LIMESTONE, WHITING

CAS:1317-65-3

RTECS #:EV9580000

Fraction by Wt: 50-95%

OSHA PEL:15 MG/CUM (DUST)

ACGIH TLV:10 MG/CUM (DUST)

Ingred Name:SILICON DIOXIDE

CAS:7631-86-9

RTECS #:VV3100000

Fraction by Wt: 5-15%

OSHA PEL:80 MG/CUM

ACGIH TLV:0.2 MG/CUM

Ingred Name:MAGNESITE (MAGNESIUM CARBONATE)

CAS:546-93-0

RTECS #:OM2470000

Fraction by Wt: 5-40%

OSHA PEL:15 MG/CUM

ACGIH TLV:10 MG/CUM

Ingred Name:RED IRON OXIDE/IRON (III) OXIDE/FERRIC OXIDE/YELLOW FERRIC
OXIDE/METAL OXIDE/YELLOW IRON OXIDE/IRON OXIDE PIGMENT/IRON

CAS:1309-37-1

RTECS #:NO7400000

Fraction by Wt: 0-20%

OSHA PEL:10 MG/M3 (FE)

ACGIH TLV:5 MG/M3 (FE), B2; 9293

===== Hazards Identification =====

Routes of Entry: Inhalation:YES Skin:YES Ingestion:NO
 Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
 Health Hazards Acute and Chronic:SKIN/EYES: IRRITATION. INHALATION:
 RESPIRATORY SYSTEM IRRITATION, ALLERGIC REACTION, & SILICOSIS.
 Explanation of Carcinogenicity:NONE
 Effects of Overexposure:SKIN/EYES: IRRITATION. INHALATION: RESPIRATORY
 SYSTEM IRRITATION, ALLERGIC REACTION, & SILICOSIS..

===== First Aid Measures =====

First Aid:EYES: FLUSH W/PLENTY OF WATER FOR 15 TO 20 MINS. SKIN: WASH
 W/SOAP OR MILD DETERGENT & WATER. INHALATION: REMOVE TO FRESH AIR.
 IF BREATHING STOPS, ADMINISTER ARTIFICIAL RESPIRATION. OBTAIN
 MEDICAL ATTENTION IN ALL CASES.

===== Accidental Release Measures =====

Spill Release Procedures:SHOVEL OR SWEEP MATERIAL INTO CONTAINER. AVOID
 CREATING AIRBORNE DUST.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:USE APPROVED DUST RESPIRATOR
 Ventilation:TO MAINTAIN DUST LEVELS <PEL/TLV.
 Protective Gloves:RECOMMENDED
 Eye Protection:GOGGLES OR FACE SHIELD
 Other Protective Equipment:LONG SLEEVED SHIRT & IMPERVIOUS CLOTHING
 Supplemental Safety and Health

===== Physical/Chemical Properties =====

Solubility in Water:COMPLETE
 Appearance and Odor:WHITE OR GRAYISH-WHITE LUMPS OR GRANULAR POWDER
 Percent Volatiles by Volume:0%

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES
 Hazardous Decomposition Products:CALCIUM OXIDE, CO2 AT HIGH
 TEMPERATURES

===== Disposal Considerations =====

Waste Disposal Methods:DISPOSE OF IN ACCORDANCE W/FEDERAL, STATE, &
 LOCAL REGULATIONS.

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 assume responsibility for the suitability of this information to their
 particular situation.

MSDS Number: A2052 ***** Effective Date: 08/03/07 ***** Supersedes 02/16/06

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc
222 Red School Lane
Phillipsburg NJ 08855



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 813-995-6666

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-552-2537) for assistance

ALCONOX®**1. Product Identification**

Synonyms: Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates and carbonates

CAS No : Not applicable

Molecular Weight: Not applicable to mixtures

Chemical Formula: Not applicable to mixtures

Product Codes: A461

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Alconox® proprietary detergent mixture	N/A	90 - 100%	Yes

3. Hazards Identification**Emergency Overview**

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT

SAF-I-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: Green (General Storage)

Potential Health Effects**Inhalation:**

May cause irritation to the respiratory tract Symptoms may include coughing and shortness of breath.

Ingestion:

May cause irritation to the gastrointestinal tract Symptoms may include nausea, vomiting and diarrhea.

Skin Contact:

No adverse effects expected

Eye Contact:

May cause irritation, redness and pain

Chronic Exposure:

No information found

Aggravation of Pre-existing Conditions:

No information found

4. First Aid Measures

Inhalation:

Remove to fresh air. Get medical attention for any breathing difficulty.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Wash exposed area with soap and water. Get medical advice if irritation develops.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not expected to be a fire hazard.

Explosion:

No information found.

Fire Extinguishing Media:

Dry chemical, foam, water or carbon dioxide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

None established.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition for details.

Personal Respirators (NIOSH Approved):

For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. If oil particles (e.g., lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear protective gloves and clean body-covering clothing.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

White powder interspersed with cream colored flakes.

Odor:

No information found.

Solubility:

Moderate (1-10%)

Specific Gravity:

No information found.

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

No information found

Melting Point:

No information found

Vapor Density (Air=1):

No information found

Vapor Pressure (mm Hg):

No information found

Evaporation Rate (BuAc=1):

No information found

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition

Hazardous Polymerization:

Will not occur.

Incompatibilities:

No information found

Conditions to Avoid:

No information found

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure

-----\Cancer Lists\-----			
Ingredient	---NIP Carcinogen---		IARC Category
	Known	Anticipated	
Alconox® proprietary detergent mixture	No	No	None

12. Ecological Information

Environmental Fate:

This product is biodegradable

Environmental Toxicity:

No information found

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	ISCA	EC	Japan	Australia
Alconox® proprietary detergent mixture	Yes	No	No	No

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	--Canada--			
	Korea	DSI	NDSI	Phil.
Alconox® proprietary detergent mixture	No	No	Yes	No

-----\Federal, State & International Regulations - Part 1\-----
-----SARA 302-----SARA 313-----
Ingredient RQ TPQ list Chemical Catg

Alconox® No No No No
proprietary detergent mixture

-----\Federal, State & International Regulations - Part 2\-----
-----RCRA-----ISCA-----
Ingredient CERCLA 261 33 8(d)

Alconox® No No No
proprietary detergent mixture

Chemical Weapons Convention: No ISCA 12(b): No CDIA: No
SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR

16. Other Information

NFPA Ratings: Health: 0 Flammability: 0 Reactivity: 0

Label Hazard Warning:

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT

Label Precautions:

Avoid contact with eyes

Keep container closed

Use with adequate ventilation

Avoid breathing dust.

Wash thoroughly after handling

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING Give large quantities of water Never give anything by mouth to an unconscious person If inhaled, remove to fresh air If not breathing give artificial respiration. If breathing is difficult, give oxygen In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes In all cases, get medical attention

Product Use:

Laboratory Reagent

Revision Information:

MSDS Section(s) changed since last revision of document include: 3

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U S A)

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Unbranded Gasoline Reformulated with Ethanol

MSDS Code: 724060

Synonyms: Arizona Clean Burning Gasoline (CBG) (All Grades)
CARB Gasoline with Ethanol (All Grades)
Conventional Unleaded Gasoline with Ethanol (All Grades)
Reformulated Gasoline with Ethanol (All Grades)

Intended Use: Fuel

Responsible Party: ConocoPhillips
600 N. Dairy Ashford
Houston, Texas 77079-1175

Customer Service: 800-640-1956

Technical Information: 800-255-9556

MSDS Information: Phone: 800-762-0942
Email: MSDS@conocophillips.com
Internet: <http://w3.conocophillips.com/NetMSDS/>

Emergency Telephone Numbers: Chemtrec: 800-424-9300 (24 Hours)
California Poison Control System: 800-356-3219

2. HAZARDS IDENTIFICATION

Emergency Overview

DANGER!

Extremely Flammable Liquid and Vapor
Eye and Skin Irritant
Aspiration Hazard

NFPA



Appearance: Clear to amber
Physical Form: Liquid
Odor: Gasoline

Potential Health Effects

Eye: Eye irritant. Contact may cause stinging, watering, redness, and swelling

Skin: Skin irritant. Contact may cause redness, itching, a burning sensation, and skin damage. Prolonged or repeated contact can defat the skin, causing drying and cracking of the skin, and possibly dermatitis (inflammation). Not acutely toxic by skin absorption, but prolonged or repeated skin contact may be harmful (see Section 11).

Inhalation (Breathing): Low to moderate degree of toxicity by inhalation.

Ingestion (Swallowing): Low degree of toxicity by ingestion. ASPIRATION HAZARD - This material can enter lungs during swallowing or vomiting and cause lung inflammation and damage

Signs and Symptoms: Effects of overexposure may include irritation of the respiratory tract, irritation of the digestive tract, nausea, vomiting, flushing, blurred vision, drunkenness, stupor, tremors, respiratory failure, signs of nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue), unconsciousness, convulsions, death.

Other Comments: Most adverse health effects associated with ethanol, a component of this material, are related to the chronic ingestion of alcoholic beverages. Alcoholism has been associated with liver, stomach, heart, and nervous system damage, cancer, adverse reproductive effects, and effects on the developing fetus. Many of these effects may be related to metabolic changes that result from constantly high blood levels of alcohol. This exposure pattern is significantly different from that of persons handling industrial ethanol in the workplace or from refueling cars with gasoline containing ethanol.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders, respiratory (asthma-like) disorders, liver disorders. Exposure to high concentrations of this material may increase the sensitivity of the heart to certain drugs. Persons with pre-existing heart disorders may be more susceptible to this effect (see Section 4 - Note to Physicians).

See Section 11 for additional Toxicity Information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS	Concentration (wt %)
Gasoline	NONE	>90
Ethanol	64-17-5	< 10
Benzene	71-43-2	0-5

4. FIRST AID MEASURES

Eye: If irritation or redness develops from exposure, flush eyes with clean water. For direct contact, hold eyelids apart and flush the affected eye(s) with clean water for at least 15 minutes. Seek medical attention.

Skin: Remove contaminated shoes and clothing, and flush affected area(s) with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. If skin surface is not damaged, cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops, seek medical attention.

Inhalation (Breathing): Immediately move victim away from exposure and into fresh air. If respiratory symptoms or other symptoms of exposure develop, seek immediate medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. If victim is drowsy or unconscious and vomiting, place on the left side with the head down. If possible, do not leave victim unattended and observe closely for adequacy of breathing. Seek medical attention.

Notes to Physician: Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of hydrocarbon solvents (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for the development of cardiac arrhythmias.

Federal regulations (29 CFR 1910.1028) specify medical surveillance programs for certain exposures to benzene above the action level or PEL (specified in Section (i)(1)(i) of the Standard). In addition, employees exposed in an emergency situation shall, as described in Section (i)(4)(i), provide a urine sample at the end of the shift for measurement of urine phenol.

5. FIRE-FIGHTING MEASURES

NFPA 704 Hazard Class

Health: 1 **Flammability:** 3 **Instability:** 0 (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

Unusual Fire & Explosion Hazards: This material is extremely flammable and can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media: Dry chemical, carbon dioxide, or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8)

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from immediate hazard area if it can be done with minimal risk.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Extremely flammable. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof electrical equipment is recommended.

Spill precautions: Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8).

Environmental precautions: Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Dike far ahead of spill for later recovery or disposal. Use foam on spills to minimize vapors (see Section 5). Spilled material may be absorbed into an appropriate absorbent material.

Methods for cleaning up: Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended.

7. HANDLING AND STORAGE

Handling: Open container slowly to relieve any pressure. Bond and ground all equipment when transferring from one vessel to another. Can accumulate static charge by flow or agitation. Can be ignited by static discharge. The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-704 and/or API RP 2003 for specific bonding/grounding requirements. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Wash thoroughly after handling. Do not wear contaminated clothing or shoes. Keep contaminated clothing away from sources of ignition such as sparks or open flames. Use good personal hygiene practices.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Storage: Keep container(s) tightly closed. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Post area "No Smoking or Open Flame." Store only in approved containers.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Component	ACGIH	OSHA	Other:
Gasoline	300 ppm TWA 890 mg/m ³ TWA 500 ppm STEL 1480 mg/m ³ STEL	—	—
Ethanol	TWA: 1000 ppm	TWA: 1000 ppm TWA: 1900 mg/m ³	—
Toluene	TWA: 20 ppm	Ceiling: 300 ppm TWA: 200 ppm	—
Xylenes	TWA: 100 ppm STEL: 150 ppm	TWA: 100 ppm TWA: 435 mg/m ³	—
Benzene	TWA: 0.5 ppm STEL: 2.5 ppm Skin	Ceiling: 25 ppm STEL: 5 ppm TWA: 1 ppm TWA: 10 ppm	—

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Contains benzene. If exposure concentrations exceed the 0.5 ppm action level, OSHA requirements for personal protective equipment, exposure monitoring, and training may apply (29CFR1910.1028). Also see Section 4.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits additional engineering controls may be required. Where explosive mixtures may be present, electrical systems safe for such locations must be used (see appropriate electrical codes).

Personal Protective Equipment (PPE):

Eye/Face: Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.

Skin: The use of nitrile gloves impervious to the specific material handled is advised to prevent skin contact, possible irritation, and skin damage (see glove manufacturer literature for information on permeability). Depending on conditions of use, nitrile apron and/or arm covers may be necessary.

Respiratory: A NIOSH certified air purifying respirator with an organic vapor cartridge may be used under conditions where airborne concentrations are expected to exceed exposure limits.

Protection provided by air purifying respirators is limited (see manufacturer's respirator selection guide). Use a NIOSH approved self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode if there is potential for an oxygen-deficient atmosphere, uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

If benzene values equal or exceed applicable exposure limits the use of respiratory protection should comply with the requirements in OSHA 29 CFR 1910.1028-Benzene.

Other Protective Equipment: A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed.

Suggestions for the use of specific protective materials are based on readily available published data. Users should check with specific manufacturers to confirm the performance of their products.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance:
Physical Form:

Clear to amber
Liquid

Odor:	Gasoline
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure:	330-775 mm Hg @ 100°F
Vapor Density (air=1):	>1
Boiling Point/Range:	81-437°F / 26-225°C
Melting/Freezing Point:	No data
Solubility in Water:	Approximately 10%
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity:	0.68-0.78 @ 60°F (15.6°C)
Bulk Density:	5.66-6.50 lbs/gal
Percent Volatile:	100%
Evaporation Rate (nBuAc=1):	>1
Flash Point:	<-49°F / <-45°C
Test Method:	(estimate)
LEL (vol % in air):	1.4
UEL (vol % in air):	7.6
Autoignition Temperature:	833°F / 445°C

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Extremely flammable liquid and vapor. Vapor can cause flash fire.

Conditions to Avoid: Avoid all possible sources of ignition (see Sections 5 and 7).

Materials to Avoid (Incompatible Materials): strong oxidizing agents such as acids, chlorine, dichromates, or permanganates can cause fire or explosion.

Hazardous Decomposition Products: The use of hydrocarbon fuel in an area without adequate ventilation may result in hazardous levels of combustion products (e.g., oxides of carbon, sulfur and nitrogen, benzene and other hydrocarbons) and/or dangerously low oxygen levels

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Chronic Data:

Gasoline

Carcinogenicity: Two year inhalation studies of wholly vaporized unleaded gasoline produced increased incidences of kidney tumors in male rats and liver tumors in female mice. Follow-up studies suggest that occurrence of the kidney tumors may be linked to alpha-2-u-globulin nephropathy, and most likely unique to the male rat. Epidemiology data collected from a study of more than 18,000 petroleum marketing and distribution workers showed no increased risk of leukemia, multiple myeloma, or kidney cancer from gasoline exposure. Unleaded gasoline has been identified as a possible carcinogen by IARC. Because solvent extracts of gasoline exhaust particulates caused skin cancer in laboratory animals, IARC has categorized gasoline engine exhaust as a possible human cancer hazard.

Target Organs: A two year inhalation study of wholly vaporized unleaded gasoline produced nephropathy in male rats, characterized by the accumulation of alpha-2-u- globulin in epithelial cells of the proximal tubules, and necrosis and hyperplasia of surrounding cells. Follow-up studies suggest that these changes are unique to the male rat

Reproductive: No evidence of developmental toxicity was found in pregnant laboratory animals (rats and mice) exposed to up to 9,000 ppm vapor of unleaded gasoline via inhalation.

Ethanol

Carcinogenicity: Ingestion of alcoholic beverages has been classified by IARC as "carcinogenic to humans" (Group 1). Occupational exposures to ethanol and exposures other than by ingestion (i.e., dermal and inhalation) have not been associated with cancer in humans.

Target Organs: Chronic alcoholism has been associated with damage to the liver in humans (e.g., cirrhosis of the liver). Excessive consumption of alcoholic beverages has also been associated with adverse effects on the central nervous system, digestive system and cardiovascular system.

Reproductive: Excessive consumption of alcoholic beverages during pregnancy has been associated with effects on the developing fetus referred to collectively as the fetal alcohol syndrome. The effects most frequently manifested include psychomotor dysfunction, growth retardation and a characteristic cluster of facial anomalies. It also affects the reproductive system including reduced sperm count and motility and loss of libido in men, abnormal menstrual function, and decreased plasma estradiol and progesterone levels in women.

Mutagenic Effects: Excessive consumption of alcoholic beverages has been associated with chromosomal aberrations in white blood cells. Depending on the animal species being tested, ethanol may produce chromosomal damage, DNA damage and mutation in both somatic and germ cells.

Xylenes

Target Organs: Rats exposed to 800, 1000 or 1200 ppm 14 hours daily for 6 weeks demonstrated high frequency hearing loss. Another study in rats exposed to 1800 ppm 8 hours daily for 5 days demonstrated middle frequency hearing loss.

Reproductive: Both mixed xylenes and the individual isomers produced limited evidence of developmental toxicity in laboratory animals. Inhalation and oral administration of xylene resulted in decreased fetal weight, increased incidences of delayed ossification, skeletal variations and resorptions.

Toluene

Target Organs: Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances.

Reproductive: Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. The effects seen include decreased fetal body weight and increased skeletal variations in both inhalation and oral studies.

Ethyl Benzene

Carcinogenicity: Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. Ethyl benzene has not been listed as a carcinogen by NTP, or OSHA.

Benzene

Carcinogenicity: Benzene is known to cause cancer of the blood-forming organs in humans, including acute myelogenous leukemia. It has been identified as a human carcinogen by NTP, IARC and OSHA.

Target Organs: Prolonged or repeated exposures to benzene vapors can cause damage to the blood and blood forming organs, including disorders like leukopenia, thrombocytopenia, and aplastic anemia.

Reproductive: Exposure to benzene during pregnancy demonstrated limited evidence of developmental toxicity in laboratory animals. The effects seen include decreased body weight and increased skeletal variations in rodents. Alterations in hematopoiesis have been observed in the fetuses and offspring of pregnant mice.

Mutagenic Effects: Benzene exposure has resulted in chromosomal aberrations in human lymphocytes and animal bone marrow cells, and DNA damage in mammalian cells in vitro.

n-Hexane

Target Organs: Excessive exposure to n-hexane can result in peripheral neuropathies. The initial symptoms are symmetrical sensory numbness and paresthesias of distal portions of the extremities. Motor weakness is typically observed in muscles of the toes and fingers but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of n-hexane are potentiated by exposure to methyl ethyl ketone and methyl isobutyl ketone.

Reproductive: Prolonged exposure to high concentrations of n-hexane (>1,000 ppm) has resulted in decreased sperm count and degenerative changes in the testes of rats but not those of mice.

Acute Data:

Component	Oral LD50	Dermal LD50	Inhalation LC50
Gasoline	18.75 ml/kg. (Rat)	>5 ml/kg (Rabbit)	300g/m ³ /5M (rat, mouse, g.pig)
Ethanol	6.2-13.7 g/kg (Rat); LD50 = 6300 mg/kg (Rabbit)	9.4 ml/kg (Rabbit)	20,000 ppm/10 hr. (Rat)

12. ECOLOGICAL INFORMATION

12. ECOLOGICAL INFORMATION

The individual hydrocarbon components of this material are differentially soluble in water with aromatic hydrocarbons tending to be more water soluble than aliphatic hydrocarbons. If spilled, the more volatile components will evaporate rapidly. Factors such as local environmental conditions (temperature, wind, soil type, mixing or wave action in water, etc), photo-oxidation, biodegradation and adsorption onto suspended sediments, contribute to the weathering of spilled material. Because of their differential solubility, the occurrence of hydrocarbons in groundwater will be at different proportions than the parent material.

The potential for bioaccumulation and/or long term persistence of these materials in the environment is low to non-existent. In laboratory soil column experiments, the half-time of unleaded gasoline was reported as 1.2 to 2.7 days in sand, loam or clay soils. Microorganisms present in sediments and in the water are capable of degrading gasoline and naphtha containing hydrocarbons. Simpler hydrocarbons are more readily degraded than complex molecules. Adaptation of bacteria in gasoline-contaminated groundwater to the soluble constituents has been reported.

In general, naphtha streams exhibit some short-term toxicity to freshwater and marine organisms, especially under closed vessel or flow-through exposure conditions in the laboratory. The components most likely causing toxicity are also highly volatile and can be readily biodegraded by microorganisms.

13. DISPOSAL CONSIDERATIONS

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations

This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste. However, it would likely be identified as a federally regulated RCRA hazardous waste for the following characteristic(s) shown below. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the MSDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.

Container contents should be completely used and containers should be emptied prior to discard. Container residues and rinseates could be considered to be hazardous wastes.

EPA Waste Number(s)

- D001 - Ignitability characteristic
- D018 - Toxicity characteristic (Benzene)

14. TRANSPORTATION INFORMATION

U.S. Department of Transportation (DOT)

Shipping Description:	Gasoline, 3, UN1203, II
Non-Bulk Package Marking:	Gasoline, UN1203
Non-Bulk Package Labeling:	Flammable liquid
Bulk Package/Placard Marking:	Flammable/1203
Packaging - References:	49 CFR 173.150; 173.202; 173.242
Emergency Response Guide:	128

International Maritime Dangerous Goods (IMDG)

Shipping Description:	UN1203, Gasoline, 3, II, (-45° C cc)
Non-Bulk Package Marking:	Gasoline, UN 1203
Labels:	Flammable liquid
Placards/Marking (Bulk):	Flammable/1203
Packaging - Non-Bulk:	P001
EMS:	F-E, S-E

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #:	UN1203
Proper Shipping Name:	Gasoline
Hazard Class/Division:	3
Packing Group:	II
Non-Bulk Package Marking:	Gasoline, UN1203
Labels:	Flammable liquid
ERG Code:	3H

14. TRANSPORTATION INFORMATION

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	Y305	305	307
Max. Net Qty. Per Package:	1 L	5 L	60 L

15. REGULATORY INFORMATION

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health:	Yes
Chronic Health:	Yes
Fire Hazard:	Yes
Pressure Hazard:	No
Reactive Hazard:	No

CERCLA/SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

Component	Concentration (wt %)	de minimis
Xylenes	0-21	1.0%
Toluene	0-15	1.0%
Ethyl Benzene	0-5	0.1%
Benzene	0-5	0.1%
1,2,4-Trimethyl Benzene	0-5	1.0%
n-Hexane	0-4	1.0%
Cyclohexane	0-4	1.0%

EPA (CERCLA) Reportable Quantity (in pounds):

EPA's Petroleum Exclusion applies to this material - (CERCLA 101(14))

California Proposition 65:

Warning: This material may contain detectable quantities of the following chemicals, known to the State of California to cause cancer, birth defects or other reproductive harm, and which may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Component	Type of Toxicity
Toluene	Developmental Toxicant
Benzene	Cancer Developmental Toxicant Male Reproductive Toxicant
Unleaded Gasoline (Wholly Vaporized)	Cancer

Canadian Regulations:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
B2 - Flammable Liquids
D2A - Very Toxic Material

National Chemical Inventories:

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.
All components are listed on the Canadian DSL.

U.S. Export Control Classification Number: EAR99

16. OTHER INFORMATION

Issue Date:	21-Jun-2007
Status:	
Previous Issue Date:	23-May-2007
Revised Sections or Basis for Revision:	Exposure limits (Section 8)
MSDS Code:	724060

MSDS Legend:

ACGIH = American Conference of Governmental Industrial Hygienists; CAS = Chemical Abstracts Service Registry; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; IARC = International Agency for Research on Cancer; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

LUCAS MATERIAL SAFETY DATA SHEET

Lucas X-Tra Heavy Duty Grease

Product Code: 10301, 10305, 10316, 10330, 10335

DIVISION AND LOCATION — SECTION I

Division: Lucas Oil Products, Inc. • 302 North Sheridan Street • Corona, CA 92880-2067

Emergency Telephone Number: (800) 342-2512

CHEMICAL AND PHYSICAL PROPERTIES — SECTION II

Chemical Name: Petroleum hydrocarbon plus additives.

Formula: N/A

Hazardous Decomposition Products: Ketones, Aldehydes, Oxides of sulfur, Oxides of nitrogen, Carbon monoxide and carbon dioxide from burning.

Incompatibility (keep away from): Strong oxidizers such as hydrogen peroxide, bromine, and chromic acid.

Toxic and Hazardous Ingredients: None

Form: Semi-solid Odor: Mineral oil Appearance: Grease

Color: Green

Specific Gravity (water = 1): .942

Melting Point: Not applicable

Solubility in Water (by weight %): Negligible at 25°C.

Stability: Product is stable under normal conditions

FIRE AND EXPLOSION DATA — SECTION III

Special Fire Fighting Procedures: Dense smoke. Fire fighters should wear an approved self-contained breathing apparatus. Do not use water except as fog.

Unusual Fire and Explosion Hazards: Dense smoke.

Flashpoint: (Method used) Cleveland open cup - greater than 190°C (374°F).

Extinguishing agent: Dry chemical or Waterfog or CO 2 or Foam or Sand/Earth. Water may cause frothing. Closed containers exposed to fire may be cooled with water.

HEALTH HAZARD DATA — SECTION IV

Chronic Effects of Over-Exposure: None when used with good personal hygiene practices. May otherwise cause skin and eye irritation upon prolonged or repeated contact.

Acute Toxicological Properties: No data available

Emergency First Aid Procedures:

Eyes: Flush with large amounts of water for at least 15 minutes. If irritation persists, call a physician.

Skin: Remove excess with cloth or paper. Wash thoroughly with soap and water.

Inhalation: Remove exposed person to fresh air, if discomfort is experienced while handling hot product.

If Swallowed: Contact a physician immediately.

SPECIAL PROTECTION INFORMATION — SECTION V

Ventilation type required (local, mechanical, special): NONE

Respiratory protection (specify type): NONE

Protective gloves: None

Eye protection: Chemical safety goggles and, if handled hot, full face shield.

Other protective equipment: None

HANDLING OF SPILLS OF LEAKS --- SECTION VI

Procedures for Clean-Up: Transfer bulk of mixture into another container. Absorb residue with an inert material such as earth, sand, or vermiculite. Sweep up and dispose as solid waste in accordance with local, state, and federal regulations.

Waste Disposal: Dispose of in accordance with all applicable federal, state, and local regulations.

SPECIAL PRECAUTIONS — SECTION VII

Precautions to be taken in handling and storage: Keep container closed until ready for use.

TRANSPORTATION DATA — SECTION VIII

D.O.T.: Not regulated

Reportable Quantity: Not applicable

Freight Classification: Petroleum Lubricating Grease

Special Transportation Notes: None

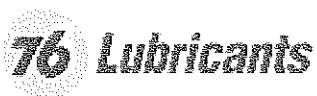
ENVIRONMENTAL/SAFETY REGULATIONS — SECTION IX

Section 313 (Title III Superfund Amendment and Reauthorization Act):

This product does not contain any chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Prepared By: Dell Findley **Title:** Lab Technician **Original Date:** 05-01-95 **Updated:** 01-01-04

We believe the statements, technical information, and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind, express or implied, and we assume no responsibility for any loss, damage, or expense, direct or consequential, arising out of their use.



MATERIAL SAFETY DATA SHEET

76 Hydraulic/Tractor Fluid

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: 76 Hydraulic/Tractor Fluid
Intended Use: Transmission Oil
Chemical Family: Petroleum Hydrocarbon

Responsible Party: ConocoPhillips Lubricants
600 N. Dairy Ashford
Houston, Texas 77079-1175

Customer Service: 800-822-6457
Technical Information: 800-766-0050

Emergency Overview

24 Hour Emergency Telephone Numbers:
Spill, Leak, Fire or Accident Call CHEMTREC:
North America: (800) 424-9300
Others: (703) 527-3887 (collect)

California Poison Control System: (800) 356-3129

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO CRITERIA OF NOHSC

Health Hazards/Precautionary Measures: Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Physical Hazards/Precautionary Measures: Keep away from all sources of ignition.

Appearance: Amber
Physical Form: Liquid
Odor: Characteristic petroleum

NFPA 704 Hazard Class

Health: 1 **Flammability:** 1 **Instability:** 0 **Legend:** 0 (Least) 1 (Slight) 2 (Moderate) 3 (High) 4 (Extreme)

2. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS					
Component	Concentration (wt %)	ACGIH:	OSHA:	NIOSH:	Other:
Zinc Compound(s)	1.0-2.0	NE	NE	NE	NE
PROPRIETARY					

NON-HAZARDOUS COMPONENTS					
Component	Concentration (wt %)	ACGIH:	OSHA:	NIOSH:	Other:
Lubricant Base Oil (Petroleum) VARIOUS	85-87	5mg/m ³ TWA 10 mg/m ³ STEL	5 mg/m ³ TWA	2500 mg/m ³ IDLH	as Oil Mist, if Generated 5 mg/m ³ NOHSC TWA
Additives PROPRIETARY	13-15	NE	NE	NE	NE

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

1%=10,000 PPM.

NE=Not Established

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Contact may cause mild skin irritation including redness, and a burning sensation. Prolonged or repeated contact can worsen irritation by causing drying and cracking of the skin leading to dermatitis (inflammation). No harmful effects from skin absorption are expected.

Inhalation (Breathing): No information available. Studies by other exposure routes suggest a low degree of toxicity by inhalation.

Ingestion (Swallowing): No harmful effects expected from ingestion.

Signs and Symptoms: Effects of overexposure may include irritation of the digestive tract nausea diarrhea Inhalation of oil mist or vapors at elevated temperatures may cause respiratory irritation.

Cancer: There is inadequate information to evaluate the cancer hazard of this material. See Section 11 for information on the individual components, if any.

Target Organs: No data available for this material.

Developmental: No data available for this material.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders.

4. FIRST AID MEASURES

Eye: If irritation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.

Skin: Wipe material from skin and remove contaminated shoes and clothing. Cleanse affected area(s) thoroughly by washing with mild soap and water and, if necessary, a waterless skin cleanser. If irritation or redness develops and persists, seek medical attention.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Notes to Physician: Acute aspirations of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities.

5. FIRE-FIGHTING MEASURES

Flammable Properties:

Flash Point:	356°F / 180°C (minimum)
Test Method:	Cleveland Open Cup (COC), ASTM D92
OSHA Flammability Class:	Not applicable
LEL (vol % in air):	No data
UEL (vol % in air):	No data
Autoignition Temperature:	No data

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire. Vapors are heavier than air and can accumulate in low areas.

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from immediate hazard area if it can be done with minimal risk.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

6. ACCIDENTAL RELEASE MEASURES

This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release.

Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Dike far ahead of spill for later recovery or disposal. Spilled material may be absorbed into an appropriate absorbent material. Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Do not wear contaminated clothing or shoes. Use good personal hygiene practices.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Storage: Keep container(s) tightly closed. Store only in approved containers. Use and store this material in cool, dry, well-ventilated areas away from heat and all sources of ignition. Storage temperatures above 113°F may lead to thermal decomposition, resulting in the generation of hydrogen sulfide and other sulfur containing gases. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional engineering controls may be required.

Personal Protective Equipment (PPE):

Respiratory: A NIOSH certified air purifying respirator with a Type 95 (R or P) particulate filter may be used under conditions where airborne concentrations are expected to exceed exposure limits (see Section 2).

Protection provided by air purifying respirators is limited (see manufacturer's respirator selection guide). Use a NIOSH approved self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode if there is potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

Skin: The use of gloves impervious to the specific material handled is advised to prevent skin contact and possible irritation (see manufacturers literature for information on permeability).

Eye/Face: Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.

Other Protective Equipment: A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed.

Suggestions for the use of specific protective materials are based on readily available published data. Users should check with specific manufacturers to confirm the performance of their products.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm).

Appearance:	Amber
Physical Form:	Liquid
Odor:	Characteristic petroleum
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure (mm Hg):	<1
Vapor Density (air=1):	>1

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point/Range:	No data
Melting/Freezing Point:	No data
Solubility in Water:	Negligible
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity:	0.86-0.88
Bulk Density:	7.16-7.33 lbs/gal
Viscosity:	8.8 - 9.9 cSt @ 100°C; 55 - 64 cSt @ 40°C
Percent Volatile:	Negligible
Evaporation Rate (nBuAc=1):	<1
Flash Point:	356°F / 180°C (minimum)
Test Method:	Cleveland Open Cup (COC), ASTM D92
LEL (vol % in air):	No data
UEL (vol % in air):	No data
Autoignition Temperature:	No data
Decomposition Temperature:	No data

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Conditions to Avoid: Extended exposure to high temperatures can cause decomposition.

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidizing agents strong reducing agents

Hazardous Decomposition Products: Combustion can yield carbon, nitrogen, sulfur, phosphorus, and zinc oxides. Hydrogen sulfide and alkyl mercaptans may also be released. Thermal decomposition may produce hydrogen sulfide and other sulfur-containing gases at temperatures greater than 113°F.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Chronic Data:

Lubricant Base Oil (Petroleum) VARIOUS

Carcinogenicity: The petroleum base oils contained in this product have been highly refined by a variety of processes including solvent extraction, hydrotreating, and/or dewaxing to remove aromatics and improve performance characteristics. All of the oils meet the IP-346 criteria of less than 3 percent PAH's and are not considered carcinogens by NTP, IARC, or OSHA.

Acute Data:

Lubricant Base Oil (Petroleum) VARIOUS

Dermal LD50= >2 g/kg

Inhalation LC50= No information available

Oral LD50= >5 g/kg

12. ECOLOGICAL INFORMATION

Lubricant oil basestocks are complex mixtures of hydrocarbons (primarily branched chain alkanes and cycloalkanes) ranging in carbon number from C15 to C50. The aromatic hydrocarbon content of these mixtures varies with the severity of the refining process. White oils have negligible levels of aromatic hydrocarbons, whereas significant proportions are found in unrefined basestocks. Olefins are found only at very low concentrations. Volatilization is not significant after release of lubricating oil basestocks to the environment due to the very low vapor pressure of the hydrocarbon constituents. In water, lubricating oil basestocks will float and will spread at a rate that is viscosity dependent. Water solubilities are very low and dispersion occurs mainly from water movement with adsorption by sediment being the major fate process. In soil, lubricating oil basestocks show little mobility and adsorption is the predominant physical process.

Both acute and chronic ecotoxicity studies have been conducted on lubricant base oils. Results indicate that the acute aquatic toxicities to fish, Daphnia, Ceriodaphnia and algal species are above 1000 mg/l using either water accommodated fractions or oil in water dispersions. Since lubricant base oils mainly contain hydrocarbons having carbon numbers in the range C15 to C50, it is predicted that acute toxicity would not be observed with these substances due to low water solubility. Results from chronic toxicity tests show that the no observed effect level (NOEL) usually exceeds 1000 mg/l for lubricant base oils with the overall weight of experimental evidence leading to the conclusion that lubricant base oils do not cause chronic toxicity to fish and invertebrates.

Large volumes spills of lubricant base oils into water will produce a layer of undissolved oil on the water surface that will cause direct physical fouling of organisms and may interfere with surface air exchange resulting in lower levels of dissolved oxygen. Petroleum products have also been associated with causing taint in fish even when the latter are caught in lightly contaminated environments. Highly refined base oils sprayed onto the surface of eggs will result in a failure to hatch.

Extensive experience from laboratory and field trials in a wide range of crops has confirmed that little or no damage is produced as a result of either aerosol exposure or direct application of oil emulsion to the leaves of crop plants. Base oils incorporated into soil have resulted in little or no adverse effects on seed germination and plant growth at contamination rates up to 4%.

13. DISPOSAL CONSIDERATIONS

This material, because of its intended use, has become used oil due to contamination by physical or chemical impurities. RECYCLE ALL USED OIL. While being recycled, used oil is regulated by 40 CFR 279. Use resulting in chemical or physical change or contamination may also subject it to regulation as hazardous waste. Under federal regulations, used oil is a solid waste managed under 40 CFR 279. However, in California, used oil is managed as hazardous waste until tested to show it is not hazardous. Consult state and local regulations regarding the proper handling of used oil. In the case of used oil, the intent to discard it may cause the used oil to be regulated as hazardous waste. Contents should be completely used and containers emptied prior to discard. Rinsate may be considered a RCRA hazardous waste and must be disposed of with care and in compliance with federal, state and local regulations. Large empty containers, such as drums, should be returned to the distributor or a drum reconditioner. To assure proper disposal of small empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORTATION INFORMATION

DOT

Shipping Description: Not regulated

Note: Material is unregulated unless shipped by land in a packaging having a capacity of 3,500 gallons or more. Then the provisions of 49 CFR, Part 130 apply.

IMDG

Shipping Description: Not regulated

ICAO/IATA

Shipping Description: Not regulated

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health:	No
Chronic Health:	No
Fire Hazard:	No
Pressure Hazard:	No

Reactive Hazard: No

CERCLA/SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:

Zinc Compound(s) PROPRIETARY 1.0-2.0%

EPA (CERCLA) Reportable Quantity (in pounds):

--None Known--

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:

-- None Known --

California Proposition 65:

Warning: This material contains the following chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

-- None Known --

Carcinogen Identification:

This material has not been identified as a carcinogen by NTP, IARC, or OSHA. See Section 11 for carcinogenicity information of individual components, if any.

TSCA:

All components are listed on the TSCA inventory

International Regulations:

Canadian Regulations: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

Domestic Substances List: Listed

WHMIS Hazard Class:

Not Regulated

Australian Regulations:

References:

Regulations Specifically Applicable to the Chemical Product:

Commonwealth of Australia: Respirators must follow AS1715/1716 standard for approved respirators.

New Zealand: Respirators must follow NZS 1715/1716 standard for approved respirators.

International (all countries): In the absence of local approved authorities, follow U.S. NIOSH/MSHA, U.K. BSI, Australian AS1715/1716, or new Zealand NZS 1715/1716 standards.

Australia Poison Schedule: Not applicable.

NZ Dangerous Goods Class: Not applicable.

Contact Point:

ConocoPhillips Lubricants Australia Pty. Ltd.

Emergency Telephone: 1-800-226626

Office Manager

Office Hours 8 a.m.-5 p.m. Monday-Friday (excluding holidays)

Tel: +61 (0) 7 5452.9900

Fax: +61 (0) 7 5452 9999

Website: www.aplubes.conocophillips.com

16. OTHER INFORMATION

Issue Date:	13-Jun-2006
Previous Issue Date:	05-Oct-2004
Revised Sections or Basis for Revision:	Periodic review and update
MSDS Code:	721190

Disclaimer of Expressed and implied Warranties:

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HNU SYSTEMS INC -- ISOBUTYLENE SPAN GAS, SEE SUPP DATA -- 6665-01-214-8247

===== Product Identification =====

Product ID:ISOBUTYLENE SPAN GAS, SEE SUPP DATA

MSDS Date:12/08/1987

ESC:6665

NIIN:01-214-8247

MSDS Number: BJDVR

==== Responsible Party ===

Company Name:HNU SYSTEMS INC

Address:160 CHARLEMONT ST

City:NEWTON HIGHLANDS

State:MA

ZIP:02161

Country:US

Info Phone Num:617/964-6690

Emergency Phone Num:800/841-4357

CAGE:57631

==== Contractor Identification ===

Company Name:HNU SYSTEMS INC

Address:160 CHARLEMONT ST

Box:City:NEWTON HIGHLANDS

State:MA

ZIP:02161

Country:US

Phone:617/964-6690

CAGE:57631

===== Composition/Information on Ingredients =====

Ingred Name:ISOBUTYLENE

CAS:115-11-7

RTECS #:UD0890000

Fraction by Wt: 0.01%

===== Hazards Identification =====

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.

Routes of Entry: Inhalation:YES Skin:NO Ingestion:NO

Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO

Health Hazards Acute and Chronic:ISOBUTYLENE IS A SIMPLE ASPHYXIAN;

MODERATE CONCENTRATION IN AIR CAUSE UNCONSCIOUSNESS. CONTACT

W/LIQUID CAUSES FROSTBITE.

Explanation of Carcinogenicity:NOT RELEVANT

Effects of Overexposure:SEE HEALTH HAZARDS.

Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

===== First Aid Measures =====

First Aid:IF BREATHED, REMOVE INDIVIDUAL TO FRESH AIR. IF BREATHING IS
DIFFICULT, ADMINISTER OXYGEN. IF BREATHING HAS STOPPED, GIVE
ARTIFICIAL RESPIRATION. KEEP PERSON WARM, QUIET; GET MEDICAL
ATTENTION.

===== Fire Fighting Measures =====

Flash Point Method:CC

Flash Point:-76 C OR -105 F

Lower Limits:1.8%
 Upper Limits:9.6%
 Extinguishing Media:CO2 OR DRY CHEMICAL
 Fire Fighting Procedures:STOP FLOW OF ISOBUTYLENE IF POSSIBLE. USE
 WATER SPRAY TO COOL SURROUNDING CONTAINERS.
 Unusual Fire/Explosion Hazard:ISOBUTYLENE IS HEAVIER THAN AIR MAY
 TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION. SHOULD FLAME BE
 EXTINGUISHED AND FLOW OF GAS CONTINUE SEE SUPP DATA.

===== Accidental Release Measures =====

Spill Release Procedures:NONE SPECIFIED BY MANUFACTURER.
 Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

===== Handling and Storage =====

Handling and Storage Precautions:STORE AWAY FROM HEAT AND PROTECT
 CYLINDERS FROM PHYSICAL DAMAGE.
 Other Precautions:DO NOT PUNCTURE CYLINDER.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:POSITIVE PRESSURE AIR LINE OR SCBA FOR EMERGENCY
 USE.
 Ventilation:HOOD W/FORCED VENTILATION TO PREVENT ACCUMULATION ABOVE
 LEL.
 Protective Gloves:PLASTIC OR RUBBER.
 Eye Protection:SAFETY GOGGLES OR GLASSES.
 Other Protective Equipment:SAFETY SHOES, SAFETY SHOWER, EYEWASH
 FOUNTAIN.
 Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.
 Supplemental Safety and Health
 MFR PART NO, TRADE NAME:CALIBRATION GAS 101- 350-N, DC102573.EXPLO
 HAZ:INCREASE VENTILATION TO PREVENT FORMATION OF FLAMMABLE MIXTURE
 IN LOW AREAS/POCKETS. NOTE:DATA GIVEN FOR PURE ISOBUTYLENE. CYLINDE
 R OF HNU SPAN GAS/ISOBUTYLENE CALIBRATION GAS CONTAINS 100 PPM IN
 ZERO AIR OR 0.01% ISOBUTYLENE IN AIR.

===== Physical/Chemical Properties =====

Boiling Pt:B.P. Text:19.6F,-6.9C
 Melt/Freeze Pt:M.P/F.P Text:-221F,-140C
 Vapor Pres:@20C 24SIG
 Vapor Density:1.95
 Spec Gravity:0.59
 Solubility in Water:UNAVAILABLE
 Appearance and Odor:CLEAR UNPLEASANT ODOR SIMILAR TO COAL GAS

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES
 OXIDIZERS.
 Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.
 Hazardous Decomposition Products:NONE

===== Disposal Considerations =====

Waste Disposal Methods:DISPOSAL MUST BE I/A/W FED, STATE AND LOCAL
 REGULATIONS.

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Material Safety Data Sheet

24 Hour Assistance:
1-847-367-7700
Rust-Oleum Corp.
www.rustoleum.com

Section 1 - Chemical Product / Company Information

Product Name: Rust-Oleum Professional Inverted Marking Paint Aerosol
 Identification Number: 2524838, 2544838, 2545838, 2564838, 2592838, 243992
 Product Use/Class: Inverted Marking Paint/Aerosol
 Supplier: Rust-Oleum Corporation
 11 Hawthorn Parkway
 Vernon Hills, IL 60061
 USA
 Preparer: Regulatory Department

Revision Date: 09/07/2007

Manufacturer: Rust-Oleum Corporation
 11 Hawthorn Parkway
 Vernon Hills, IL 60061
 USA

Section 2 - Composition / Information On Ingredients

Chemical Name	CAS Number	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA PEL-CEILING
Acetone	67-64-1	30.0	500 PPM	750 PPM	750 PPM	N.E.
Liquefied Petroleum Gas	68476-86-8	30.0	1000 PPM	N.E.	1000 PPM	N.E.
Aliphatic Hydrocarbon	64742-89-8	15.0	300 PPM	N.E.	300 PPM	N.E.
Titanium Dioxide	13463-67-7	15.0	10 mg/m3	N.E.	10 mg/m3	N.E.
Toluene	108-88-3	10.0	50 PPM	150 PPM	200 PPM	300 PPM
Naphtha	8032-32-4	10.0	300 PPM	N.E.	N.E.	N.E.
Xylene	1330-20-7	10.0	100 PPM	150 PPM	100 PPM	N.E.
Magnesium Silicate	14807-96-6	5.0	10 mg/m3	N.E.	15 mg/m3	N.E.
Ethylbenzene	100-41-4	5.0	100 PPM	125 PPM	100 PPM	N.E.
Calcined Aluminum Silicate	1332-58-7	5.0	2 mg/m3	N.E.	5 mg/m3	N.E.
Microcrystalline Silica	14808-60-7	1.0	0.025 mg/m3	N.E.	0.10 mg/m3	N.E.

Section 3 - Hazards Identification

*** Emergency Overview ***: Contents Under Pressure. Harmful if inhaled. May affect the brain or nervous system causing dizziness, headache or nausea. Vapors may cause flash fire or explosion. Extremely flammable liquid and vapor. Harmful if swallowed.

Effects Of Overexposure - Eye Contact: Causes eye irritation.

Effects Of Overexposure - Skin Contact: Prolonged or repeated contact may cause skin irritation. Substance may cause slight skin irritation.

Effects Of Overexposure - Inhalation: High vapor concentrations are irritating to the eyes, nose, throat and lungs. Avoid breathing vapors or mists. High gas, vapor, mist or dust concentrations may be harmful if inhaled. Harmful if inhaled.

Effects Of Overexposure - Ingestion: Aspiration hazard if swallowed; can enter lungs and cause damage. Substance may be harmful if swallowed.

Effects Of Overexposure - Chronic Hazards: IARC lists Ethylbenzene as a possible human carcinogen (group 2B).

May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Overexposure to xylene in laboratory animals has been associated with liver abnormalities, kidney, lung, spleen, eye and blood damage as well as reproductive disorders. Effects in humans, due to chronic overexposure, have included liver, cardiac abnormalities and nervous system damage. Overexposure to toluene in laboratory animals has been associated with liver abnormalities, kidney, lung and spleen damage. Effects in humans have included liver and cardiac abnormalities. Contains crystalline silica as silicon dioxide. Excessive inhalation of respirable crystalline silica dust may cause lung disease, silicosis or lung cancer. Significant exposure is not anticipated during brush or trowel application or drying. Risk of overexposure depends on the duration and level of exposure to dust from repeated sanding of surfaces, mechanical abrasion or spray mist and actual concentration of crystalline silica in the formula. Crystalline silica is listed as Group 1 "carcinogenic to humans" by the International Agency for Research on Cancer (IARC,) and Group 2, "reasonably anticipated to be a carcinogen" by the National Toxicology Program (NTP)

Primary Route(s) Of Entry: Skin Contact, Skin Absorption, Inhalation, Eye Contact

Section 4 - First Aid Measures

First Aid - Eye Contact: Hold eyelids apart and flush with plenty of water for at least 15 minutes. Get medical attention.

First Aid - Skin Contact: Wash with soap and water. Get medical attention if irritation develops or persists.

First Aid - Inhalation: If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately.

First Aid - Ingestion: Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. Get immediate medical attention.

Section 5 - Fire Fighting Measures

Flash Point: -156 F
(Setaflash)

LOWER EXPLOSIVE LIMIT: 0.7 %
UPPER EXPLOSIVE LIMIT : 12.8 %

Extinguishing Media: Dry Chemical, Foam, Water Fog

Unusual Fire And Explosion Hazards: FLASH POINT IS LESS THAN 20 ° F. - EXTREMELY FLAMMABLE LIQUID AND VAPOR! Water spray may be ineffective. Closed containers may explode when exposed to extreme heat. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Perforation of the pressurized container may cause bursting of the can. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame.

Special Firefighting Procedures: Evacuate area and fight fire from a safe distance.

Section 6 - Accidental Release Measures

Steps To Be Taken If Material Is Released Or Spilled: Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools. Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Dispose of according to local, state (provincial) and federal regulations. Do not incinerate closed containers.

Section 7 - Handling And Storage

Handling: Wash hands before eating. Wash thoroughly after handling. Avoid breathing vapor or mist. Use only in a well-ventilated area. Follow all MSDS/label precautions even after container is emptied because it may retain product residues.

Storage: Contents under pressure. Do not expose to heat or store above 120 ° F. Do not store above 120 ° F. Store large quantities in buildings designed and protected for storage of NFPA Class I flammable liquids. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Prevent build-up of vapors by opening all doors and windows to achieve cross-ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment.

Respiratory Protection: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. A NIOSH/MSHA approved air purifying respirator with an organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.

Protection provided by air purifying respirators is limited. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

Skin Protection: Nitrile or Neoprene gloves may afford adequate skin protection. Use impervious gloves to prevent skin contact and absorption of this material through the skin.

Eye Protection: Use safety eyewear designed to protect against splash of liquids.

Other protective equipment: Refer to safety supervisor or industrial hygienist for further information regarding personal protective equipment and its application.

Hygienic Practices: Wash thoroughly with soap and water before eating, drinking or smoking

Section 9 - Physical And Chemical Properties

Boiling Range:	-34 .. 900 F	Vapor Density:	Heavier than air
Odor:	Solvent Like	Odor Threshold:	ND
Appearance:	Liquid	Evaporation Rate:	Faster than Ether
Solubility in H2O:	Slight		
Freeze Point:	ND	Specific Gravity:	
Vapor Pressure:	ND	PH:	NE
Physical State:	Liquid		

(See section 16 for abbreviation legend)

Section 10 - Stability And Reactivity

Conditions To Avoid: Avoid temperatures above 120 ° F. Avoid all possible sources of ignition.

Incompatibility: Incompatible with strong oxidizing agents, strong acids and strong alkalies.

Hazardous Decomposition: When heated to decomposition, it emits acrid smoke and irritating fumes. By open

flame, carbon monoxide and carbon dioxide.

Hazardous Polymerization: Will not occur under normal conditions.

Stability: This product is stable under normal storage conditions.

Section 11 - Toxicological Information

Product LD50: ND

Product LC50: ND

Chemical Name

	LD50	LC50
Acetone	N.D.	N.D.
Liquefied Petroleum Gas	N.D.	N.D.
Aliphatic Hydrocarbon	N.D.	N.D.
Titanium Dioxide	>7500 mg/kg (ORAL, RAT)	N.D.
Toluene	636 mg/kg (Oral, Rat)	49 gm/M3 (Inhalation, Rat)
Naphtha	>5000 mg/kg (ORAL, RAT)	N.D.
Xylene	4300 mg/kg (Oral Rat)	5000 ppm/4hr (Inhalation, Rat)
Magnesium Silicate	N.D.	TCLo:11mg/m3 inh.
Ethylbenzene	3500 mg/kg (ORAL, RAT)	N.D.
Calcined Aluminum Silicate	5000 mg/kg (ORAL RAT)	N.D.
Microcrystalline Silica	N.D.	N.D.

Section 12 - Ecological Information

Ecological Information: Product is a mixture of listed components

Section 13 - Disposal Information

Disposal Information: Dispose of material in accordance to local, state and federal regulations and ordinances. Do not allow to enter storm drains or sewer systems.

Section 14 - Transportation Information

DOT Proper Shipping Name:	Aerosol	Packing Group:	---
DOT Technical Name:	---	Hazard Subclass:	---
DOT Hazard Class:	2.1	Resp. Guide Page:	126
DOT UN/NA Number:	UN1950		

Section 15 - Regulatory Information

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

IMMEDIATE HEALTH HAZARD, CHRONIC HEALTH HAZARD, FIRE HAZARD

SARA Section 313:

Listed below are the substances (if any) contained in this product that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

<u>Chemical Name</u>	<u>CAS Number</u>
Toluene	108-88-3
Xylene	1330-20-7
Ethylbenzene	100-41-4

Toxic Substances Control Act:

Listed below are the substances (if any) contained in this product that are subject to the reporting requirements of TSCA 12(B) if exported from the United States:

None known

U.S. State Regulations: As follows -

New Jersey Right-to-Know:

The following materials are non-hazardous, but are among the top five components in this product.

<u>Chemical Name</u>	<u>CAS Number</u>
Calcium Carbonate	1317-65-3
Modified Alkyd	PROPRIETARY

Pennsylvania Right-to-Know:

The following non-hazardous ingredients are present in the product at greater than 3%.

<u>Chemical Name</u>	<u>CAS Number</u>
Calcium Carbonate	1317-65-3
Modified Alkyd	PROPRIETARY

California Proposition 65:

WARNING! This product contains a chemical(s) known by the State of California to cause cancer.

WARNING! This product contains a chemical(s) known to the state of California to cause birth defects or other reproductive harm.

International Regulations: As follows -

CANADIAN WHMIS:

This MSDS has been prepared in compliance with Controlled Product Regulations except for the use of the 16 headings.

CANADIAN WHMIS CLASS: AB5, D2A, D2B

Section 16 - Other Information

HMIS Ratings:

Health: 2

Flammability: 4

Reactivity: 0

Personal Protection: X

VOLATILE ORGANIC COMPOUNDS, g/l: NA

REASON FOR REVISION:

Legend: N.A. - Not Applicable, N.E. - Not Established, N.D. - Not Determined

The information contained on this MSDS has been checked and should be accurate. However, it is the responsibility of the user to comply with all Federal, State, and Local laws and regulations.



MATERIAL SAFETY DATA SHEET

66 TropArtic® Motor Oil (All Grades)

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: 66 TropArtic® Motor Oil (All Grades)
Synonyms: 66 TropArtic® Motor Oil, SAE 10W-40
66 TropArtic® Motor Oil, SAE 30

Intended Use: Crankcase Oil
Chemical Family: Petroleum Hydrocarbon

Responsible Party: ConocoPhillips Lubricants
600 N. Dairy Ashford
Houston, Texas 77079-1175

Customer Service: 800-822-6457
Technical Information: 800-766-0050

Emergency Overview

24 Hour Emergency Telephone Numbers:
Spill, Leak, Fire or Accident Call CHEMTREC:
North America: (800) 424-9300
Others: (703) 527-3887 (collect)

California Poison Control System: (800) 356-3219

Health Hazards/Precautionary Measures: Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Physical Hazards/Precautionary Measures: Keep away from all sources of ignition.

Appearance: Amber
Physical Form: Liquid
Odor: Characteristic petroleum

NFPA 704 Hazard Class:
Health: 1 (Slight)
Flammability: 1 (Slight)
Instability: 0 (Least)

2. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS

Component / CAS No:	Concentration (wt %)	ACGIH:	OSHA:	NIOSH:	Other:
Zinc Compound(s) PROPRIETARY	0.5 - 1.5	NE	NE	NE	NE

NON-HAZARDOUS COMPONENTS					
Component / CAS No:	Concentration (wt %)	ACGIH:	OSHA:	NIOSH:	Other:
Lubricant Base Oil (Petroleum) VARIOUS	76 - 91	5mg/m ³ TWA 10 mg/m ³ STEL	5 mg/m ³ TWA	2500 mg/m ³ IDLH	as Oil Mist, if Generated 5 mg/m ³ NOHSC TWA
Additives PROPRIETARY	9 - 24	NE	NE	NE	NE

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

1%=10,000 PPM.
NE=Not Established

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Contact may cause mild skin irritation including redness, and a burning sensation. Prolonged or repeated contact can worsen irritation by causing drying and cracking of the skin leading to dermatitis (inflammation). No harmful effects from skin absorption are expected.

Inhalation (Breathing): No information available. Studies by other exposure routes suggest a low degree of toxicity by inhalation.

Ingestion (Swallowing): No harmful effects expected from ingestion.

Signs and Symptoms: Effects of overexposure may include irritation of the digestive tract, nausea, diarrhea. Inhalation of oil mist or vapors at elevated temperatures may cause respiratory irritation.

Cancer: There is inadequate information to evaluate the cancer hazard of this material. See Section 11 for information on the individual components, if any.

Target Organs: No data available for this material.

Developmental: No data available for this material

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders.

4. FIRST AID MEASURES

Eye: If irritation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.

Skin: Wipe material from skin and remove contaminated shoes and clothing. Cleanse affected area(s) thoroughly by washing with mild soap and water and, if necessary, a waterless skin cleanser. If irritation or redness develops and persists, seek medical attention.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Notes to Physician:

Acute aspirations of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities

5. FIRE-FIGHTING MEASURES

Flammable Properties:

Flash Point:	365°F / 185°C (minimum)
Test Method:	Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
OSHA Flammability Class:	Not applicable
LEL%:	No data
UEL%:	No data
Autoignition Temperature:	No data

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire. Vapors are heavier than air and can accumulate in low areas.

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from immediate hazard area if it can be done with minimal risk.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

6. ACCIDENTAL RELEASE MEASURES

This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release.

Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Dike far ahead of spill for later recovery or disposal. Spilled material may be absorbed into an appropriate absorbent material.

Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Do not wear contaminated clothing or shoes. Use good personal hygiene practices.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Storage: Keep container(s) tightly closed. Store only in approved containers. Use and store this material in cool, dry, well-ventilated areas away from heat and all sources of ignition. Storage temperatures above 113°F may lead to thermal decomposition, resulting in the generation of hydrogen sulfide and other sulfur containing gases. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional engineering controls may be required.

Personal Protective Equipment (PPE):

Respiratory: A NIOSH certified air purifying respirator with a Type 95 (R or P) particulate filter may be used under conditions where airborne concentrations are expected to exceed exposure limits (see Section 2).

Protection provided by air purifying respirators is limited (see manufacturer's respirator selection guide). Use a NIOSH approved self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode if there is potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

Skin: The use of gloves impervious to the specific material handled is advised to prevent skin contact and possible irritation (see manufacturers literature for information on permeability).

Eye/Face: Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.

Other Protective Equipment: A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed.

Suggestions for the use of specific protective materials are based on readily available published data. Users should check with specific manufacturers to confirm the performance of their products.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm).

Appearance:	Amber
Physical Form:	Liquid
Odor:	Characteristic petroleum
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure (mm Hg):	<1
Vapor Density (air=1):	>1

Boiling Point:	No data
Solubility in Water:	Negligible
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity:	0.86-0.88
Bulk Density:	7.16-7.33 lbs/gal
Viscosity cSt @ 100°C:	10.5 - 16.1
Viscosity cSt @ 40°C:	88 - 116
Percent Volatile:	Negligible
Evaporation Rate (nBuAc=1):	<1
Flash Point:	365°F / 185°C (minimum)
Test Method:	Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
LEL%:	No data
UEL%:	No data
Autoignition Temperature:	No data
Decomposition Temperature:	No data

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure

Conditions to Avoid: Extended exposure to high temperatures can cause decomposition.

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidizing agents, strong reducing agents.

Hazardous Decomposition Products: Combustion can yield carbon, nitrogen, sulfur, phosphorus, and zinc oxides. Hydrogen sulfide and alkyl mercaptans may also be released. Thermal decomposition may produce hydrogen sulfide and other sulfur-containing gases at temperatures greater than 113°F.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Chronic Data:

This material has not been identified as a carcinogen by NTP, IARC, or OSHA.

Acute Data:

Additives (PROPRIETARY)

Dermal LD50 = No information available

LC50 = No information available

Oral LD50 = No information available

Zinc Compound(s) (PROPRIETARY)

Dermal LD50 = No information available

LC50 = No information available

Oral LD50 = No information available

Lubricant Base Oil (Petroleum) (VARIOUS)

Dermal LD50 = >2 g/kg

LC50 = No information available

Oral LD50 = >5 g/kg

12. ECOLOGICAL INFORMATION

Lubricant oil basestocks are complex mixtures of hydrocarbons (primarily branched chain alkanes and cycloalkanes) ranging in carbon number from C15 to C50. The aromatic hydrocarbon content of these mixtures varies with the severity of the refining process. White oils have negligible levels of aromatic hydrocarbons, whereas significant proportions are found in unrefined basestocks. Olefins are found only at very low concentrations. Volatilization is not significant after release of lubricating oil basestocks to the environment due to the very low vapor pressure of the hydrocarbon constituents. In water, lubricating oil basestocks will float and will spread at a rate that is viscosity dependent. Water solubilities are very low and dispersion occurs mainly from water movement with adsorption by sediment being the major fate process. In soil, lubricating oil basestocks show little mobility and adsorption is the predominant physical process.

Both acute and chronic ecotoxicity studies have been conducted on lubricant base oils. Results indicate that the acute aquatic toxicities to fish, Daphnia, Ceriodaphnia and algal species are above 1000 mg/l using either water accommodated fractions or oil in water dispersions. Since lubricant base oils mainly contain hydrocarbons having carbon numbers in the range C15 to C50, it is predicted that acute toxicity would not be observed with these substances due to low water solubility. Results from chronic toxicity tests show that the no observed effect level (NOEL) usually exceeds 1000 mg/l for lubricant base oils with the overall weight of experimental evidence leading to the conclusion that lubricant base oils do not cause chronic toxicity to fish and invertebrates.

Large volumes spills of lubricant base oils into water will produce a layer of undissolved oil on the water surface that will cause direct physical fouling of organisms and may interfere with surface air exchange resulting in lower levels of dissolved oxygen. Petroleum products have also been associated with causing taint in fish even when the latter are caught in lightly contaminated environments. Highly refined base oils sprayed onto the surface of eggs will result in a failure to hatch.

Extensive experience from laboratory and field trials in a wide range of crops has confirmed that little or no damage is produced as a result of either aerosol exposure or direct application of oil emulsion to the leaves of crop plants. Base oils incorporated into soil have resulted in little or no adverse effects on seed germination and plant growth at contamination rates up to 4%.

13. DISPOSAL CONSIDERATIONS

This material under most intended uses would become used oil due to contamination by physical or chemical impurities. RECYCLE ALL USED OIL. While being recycled, used oil is regulated by 40 CFR 279. Use resulting in chemical or physical change or contamination may also subject it to regulation as hazardous waste. Under federal regulations, used oil is a solid waste managed under 40 CFR 279. However, in California, used oil is managed as hazardous waste until tested to show it is not hazardous. Consult state and local regulations regarding the proper handling of used oil. In the case of used oil, the intent to discard it may cause the used oil to be regulated as hazardous waste.

Contents should be completely used and containers emptied prior to discard. Rinsate may be considered a RCRA hazardous waste and must be disposed of with care and in compliance with federal, state and local regulations. Large empty containers, such as drums, should be returned to the distributor or a drum reconditioner. To assure proper disposal of small empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORTATION INFORMATION

DOT

Shipping Description: Not Regulated

Note: Material is unregulated unless shipped by land in a packaging having a capacity of 3500 gallons or more. Then the provisions of 49 CFR, Part 130 apply.

IMDG

Shipping Description: Not regulated

ICAO/IATA

Shipping Description: Not regulated

15. REGULATORY INFORMATION

U.S. Regulations:

EPA SARA 311/312 (Title III Hazard Categories)

Acute Health: Yes
Chronic Health: No

Fire Hazard: No
Pressure Hazard: No
Reactive Hazard: No

SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:

Zinc Compound(s) PROPRIETARY 0.5 - 1.5%

EPA (CERCLA) Reportable Quantity (in pounds):

--None Known--

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:

-- None Known --

California Proposition 65:

Warning: This material contains the following chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Used engine oils, while not a component of this material, is on the Proposition 65 list of chemicals known to the State of California to cause cancer.

Carcinogen Identification:

This material has not been identified as a carcinogen by NTP, IARC, or OSHA. See Section 11 for carcinogenicity information of individual components, if any.

Used motor oil has been identified as a possible skin carcinogen by IARC.

TSCA:

All components are listed on the TSCA inventory.

International Regulations:

Canadian Regulations: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

Domestic Substances List: Listed

WHMIS Hazard Class:

Not Regulated

16. OTHER INFORMATION

Issue Date:	09-Jan-2006
Previous Issue Date:	12-Sep-2005
Revised Sections or Basis for Revision:	Product Name / Synonyms (Section 1) Composition (Section 2)
Previous Product Code:	P423200000
MSDS Code:	001998

Disclaimer of Expressed and implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.



No. 2 Diesel Fuel

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: No. 2 Diesel Fuel

MSDS Code: 001847

Synonyms: CARB Diesel TF3; CARB Diesel; CARB Diesel 10%
CARB Diesel Ultra Low Sulfur - Dyed and Undyed
EPA Low Sulfur Diesel Fuel - Dyed and Undyed
EPA Off Road High Sulfur Diesel - Dyed
High Sulfur Diesel Fuel; Low Sulfur Diesel Fuel
No. 2 Diesel Fuel Oil
No. 2 High Sulfur Diesel - Dyed
No. 2 Low Sulfur Diesel - Dyed; No. 2 Low Sulfur Diesel - Undyed
No. 2 Low Sulfur Distillate
No. 2 Diesel with Renewable Diesel
No. 2 Ultra Low Sulfur Diesel - Dyed; No. 2 Ultra Low Sulfur Diesel - Undyed
Super Diesel Fuel; Super Diesel Fuel II-LS
Virgin Diesel Fuel; No. 2 Distillate
ULSD
Super Diesel Fuel; Super Diesel Fuel II-LS
Virgin Diesel Fuel

Intended Use: Fuel

Responsible Party: ConocoPhillips
600 N. Dairy Ashford
Houston, Texas 77079-1175

MSDS Information: Phone: 800-762-0942
Email: MSDS@conocophillips.com
Internet: <http://w3.conocophillips.com/NetMSDS/>

Emergency Telephone Numbers: Chemtrec: 800-424-9300 (24 Hours)
California Poison Control System: 800-356-3219

2. HAZARDS IDENTIFICATION

Emergency Overview

WARNING!

Flammable Liquid and Vapor
Skin Irritant
Aspiration Hazard

NFPA



Appearance: Straw colored to dyed red

Physical Form: Liquid

Odor: Diesel fuel

Potential Health Effects

Eye: Contact may cause mild eye irritation including stinging, watering, and redness

Skin: Mild to moderate skin irritant. Contact may cause redness, itching, a burning sensation, and skin damage. Prolonged or repeated contact may cause drying and cracking of the skin, dermatitis (inflammation), burns, and severe skin damage. No harmful effects from skin absorption have been reported.

Inhalation (Breathing): No information available on acute toxicity.

Ingestion (Swallowing): Low degree of toxicity by ingestion. ASPIRATION HAZARD - This material can enter lungs during swallowing or vomiting and cause lung inflammation and damage.

Signs and Symptoms: Effects of overexposure may include irritation of the digestive tract, irritation of the respiratory tract, nausea, diarrhea and signs of nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue).

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders.

See Section 11 for additional Toxicity Information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS	Concentration (wt %)
Diesel Fuel No. 2	68476-34-6	95-100
Renewable Diesel	Proprietary	0-5
Naphthalene	91-20-3	<1

4. FIRST AID MEASURES

Eye: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin: Remove contaminated shoes and clothing, and flush affected area(s) with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. If skin surface is not damaged, cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops, seek medical attention.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention.

Ingestion (Swallowing): Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. If victim is drowsy or unconscious and vomiting, place on the left side with the head down. If possible, do not leave victim unattended and observe closely for adequacy of breathing. Seek medical attention.

5. FIRE-FIGHTING MEASURES

NFPA 704 Hazard Class

Health: 1 **Flammability:** 2 **Instability:** 0 (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

Unusual Fire & Explosion Hazards: Flammable. This material can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. Vapors are heavier than air and can accumulate in low areas. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media: Dry chemical, carbon dioxide, or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from immediate hazard area if it can be done with minimal risk. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Flammable. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof electrical equipment is recommended. Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop spill/release if it can be done with minimal risk. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use foam on spills to minimize vapors (see Section 5). Use water sparingly to minimize environmental contamination and reduce disposal requirements.

Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

Methods for Containment and Clean-Up: Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling: Wear protective gloves. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment.

Open container slowly to relieve any pressure. Bond and ground all equipment when transferring from one vessel to another. Can accumulate static charge by flow or agitation. Can be ignited by static discharge. The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-704 and/or API RP 2003 for specific bonding/grounding requirements. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes. Keep contaminated clothing away from sources of ignition such as sparks or open flames.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Conditions for safe storage: Keep container(s) tightly closed. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Store only in approved containers. Post area "No Smoking or Open Flame." Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Component	ACGIH	OSHA	Other:
Diesel Fuel No. 2	TWA: 100 mg/m ³ Skin	---	---
Naphthalene	TWA: 10 ppm STEL: 15 ppm Skin	TWA: 10 ppm TWA: 50 mg/m ³	TWA: 0.2 mg/m ³ (as total of 17 PNA's measured by NIOSH Method 5506) (ConocoPhillips Guidelines)

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Personal Protective Equipment (PPE):

Eye/Face: The use of eye protection that meets or exceeds ANSI Z.87.1 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, a face shield may be necessary.

Skin: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the performance of their products. Suggested protective materials: Nitrile

Respiratory: Where there is potential for airborne exposure above the exposure limit a NIOSH certified air purifying respirator equipped with organic vapor cartridges/canisters may be used.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use. Air purifying respirators provide limited protection and cannot be used in atmospheres that exceed the maximum use concentration (MUC) as directed by regulation or the manufacturer's instructions, in oxygen deficient (less than 19.5 percent oxygen) situations, or other conditions that are immediately dangerous to life and health (IDLH).

Other Protective Equipment: Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance:	Straw colored to dyed red
Physical Form:	Liquid
Odor:	Diesel fuel
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure:	0.40 mm Hg
Vapor Density (air=1):	> 3
Boiling Point/Range:	300-690°F / 149-366°C
Melting/Freezing Point:	No data
Solubility in Water:	Negligible
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity:	0.81-0.88 @ 60°F (15.6°C)
Bulk Density:	7.08 lbs/gal
Percent Volatile:	Negligible @ ambient conditions
Evaporation Rate (nBuAc=1):	<1
Flash Point:	125 -180°F / 52 - 82°C
Test Method:	Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
LEL (vol % in air):	0.3
UEL (vol % in air):	10.0
Autoignition Temperature:	500°F / 260°C

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated conditions of storage and handling. Flammable liquid and vapor. Vapor can cause flash fire.

Conditions to Avoid: Avoid high temperatures and all sources of ignition. Prevent vapor accumulation.

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, etc.

Hazardous Decomposition Products: Combustion can yield oxides of carbon, nitrogen and sulfur.

Hazardous Polymerization: Not known to occur.

11. TOXICOLOGICAL INFORMATION

Chronic Data:

Diesel Fuel No. 2

Carcinogenicity: Petroleum middle distillates have been shown to cause skin tumors in mice following repeated and prolonged skin contact. Follow-up studies have shown that these tumors are produced through a non-genotoxic mechanism associated with frequent cell damage and repair, and that they are not likely to cause tumors in the absence of prolonged skin irritation. Animal studies have also shown that washing the skin with soap and water can reduce the tumor response. Middle distillates with low polynuclear aromatic hydrocarbon content have not been identified as a carcinogen by NTP, IARC or OSHA. Diesel exhaust has been identified as a probable cancer hazard by IARC.

Target Organs: Limited evidence of renal impairment has been noted from a few older case reports involving excessive exposure to diesel fuel No. 2. However, renal toxicity has not been demonstrated to be a consistent finding of diesel fuel exposure.

Naphthalene

Carcinogenicity: Naphthalene has been evaluated in two year inhalation studies in both rats and mice. The National Toxicology Program (NTP) concluded that there is clear evidence of carcinogenicity in male and female rats based on increased incidences of respiratory epithelial adenomas and olfactory epithelial neuroblastomas of the nose. NTP found some evidence of carcinogenicity in female mice (alveolar adenomas) and no evidence of carcinogenicity in male mice. Naphthalene has been identified as a carcinogen by IARC and NTP.

Acute Data:

Component	Oral LD50	Dermal LD50	Inhalation LC50
Diesel Fuel No. 2	9 ml/kg (Rat)	>5ml/kg (Rabbit)	No data available
Renewable Diesel	9 ml/kg (Rat)	>5ml/kg (Rabbit)	No data available

12. ECOLOGICAL INFORMATION

When middle distillate hydrocarbons escape into the environment due to leaks or spills, most of their constituent hydrocarbons will evaporate and be photodegraded by reaction with hydroxyl radicals in the atmosphere. The half-lives in air for many of the individual hydrocarbons is less than one day. Less volatile hydrocarbons can persist in the aqueous environment for longer periods. They remain floating on the surface of the water; those that reach soil or sediment biodegrade relatively slowly. Soil contaminated with middle distillates can develop adapted microbial species able to use the fuel as a carbon source; soil aeration and nutrient supplementation can enhance this biodegradation.

Reported LC50/EC50 values for water-soluble fractions of middle distillates are usually in the range of 10 to 100 mg/liter. Adverse effects on the gills, pseudobranch, kidney and nasal mucosa have been reported in fish involved in spills of middle distillates. Juvenile clams may be particularly sensitive to marine sediments contaminated as a result of spilled material. Direct toxicity and fouling of sea birds can occur if birds dive through floating layers of spilled material.

Phytotoxic effects of middle distillate hydrocarbons have been reported following exposure of plants to sprays or vapors. Lack of seed germination and inhibition of seedling growth may also occur. There is evidence for moderate bioaccumulation of the water-soluble hydrocarbons present in middle distillates.

13. DISPOSAL CONSIDERATIONS

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations.

This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste. However, it would likely be identified as a federally regulated RCRA hazardous waste for the following characteristic(s) shown below. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the MSDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.

Container contents should be completely used and containers should be emptied prior to discard. Container residues and rinseates could be considered to be hazardous wastes.

EPA Waste Number(s)

- D001 - Ignitability characteristic

14. TRANSPORTATION INFORMATION

U.S. Department of Transportation (DOT)

Shipping Description: Diesel fuel, Combustible liquid, NA1993, III
Non-Bulk Package Marking: Not Regulated [49 CFR 173.150(f)(2)]
Non-Bulk Package Labeling: Not Regulated [49 CFR 173.150(f)(2)]
Bulk Package/Placard Marking: Combustible / 1993
Packaging - References: None; None; 49 CFR 173.241
(Exceptions; Non-bulk; Bulk)
Hazardous Substance: See Section 15 for RQ's
Emergency Response Guide: 128

International Maritime Dangerous Goods (IMDG)

Shipping Description: Not regulated if flashpoint is >60° C closed-cup
Non-Bulk Package Marking: Diesel fuel, UN1202
Labels: Flammable liquid
Placards/Marking (Bulk): Flammable / 1202
Packaging - Non-Bulk: P001, LP01
EMS: F-E, S-E
Note: Proper Shipping name can be: Gas Oil or Diesel fuel or Heating Oil, light

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #: Not regulated if flashpoint is >60° C closed-cup
UN1202
Proper Shipping Name: Diesel fuel
Hazard Class/Division: 3
Subsidiary risk: None
Packing Group: III
Non-Bulk Package Marking: Diesel fuel, UN1202
Labels: Flammable liquid
ERG Code: 3L
Note: Proper Shipping name can be: Gas Oil or Diesel fuel or Heating Oil, light

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	Y309	309	310
Max. Net Qty. Per Package:	10 L	60 L	220 L

15. REGULATORY INFORMATION

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health: Yes
Chronic Health: Yes
Fire Hazard: Yes
Pressure Hazard: No
Reactive Hazard: No

CERCLA/SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

Component	Concentration (wt %)	de minimis
Naphthalene	<1	0.1%

EPA (CERCLA) Reportable Quantity (in pounds):

EPA's Petroleum Exclusion applies to this material - (CERCLA 101(14)).

California Proposition 65:

Warning: This material may contain detectable quantities of the following chemicals, known to the State of California to cause cancer, birth defects or other reproductive harm, and which may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Component	Type of Toxicity
Naphthalene	Cancer
Toluene	Developmental Toxicant
Benzene	Cancer Developmental Toxicant Male Reproductive Toxicant

Canadian Regulations:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class
B3 - Combustible Liquids
D2A
D2B

National Chemical Inventories:

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.
All components are either on the DSL, or are exempt from DSL listing requirements.

U.S. Export Control Classification Number: EAR99

16. OTHER INFORMATION

Issue Date: 02-Jan-2008
Status:
Previous Issue Date: 12-Mar-2007
Revised Sections or Basis for Revision: Product Name / Synonyms (Section 1)
Composition (Section 3)
MSDS Code: 001847

MSDS Legend:

ACGIH = American Conference of Governmental Industrial Hygienists; CAS = Chemical Abstracts Service Registry; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; IARC = International Agency for Research on Cancer; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.



410 North Michigan Avenue
Chicago, IL 60611

Material Safety Data Sheet

Floor Absorbent (#1003000)

(800) 424-9300 Emergency (312) 321-1515 Information

1. PRODUCT IDENTIFICATION

MSDS Number: 1003000
Identity: Floor Absorbent
Issued: January 3, 2005
Chemical Name: Fullers Earth

2. COMPOSITION

Component	CAS Number	Amount	Exposure Limit
Quartz (crystalline silica) 0.000085% in the respirable range	14808-60-7	10-20% bulk	PEL - 10 mg/m ³ /%SiO ₂ +2 TWA TLV - 0.05 mg/m ³ TWA
Fullers Earth	8031-18-3	80-90%	PEL - 5 mg/m ³ TWA (respirable fraction) TLV - 3 mg/m ³ TWA (respirable fraction) TLV - 10 mg/m ³ TWA (inhalable dust)

PEL-OSHA Permissible Exposure Limit TLV - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.
TWA - 8 hour Weighted Average STEL - Short Term Exposure Limit

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

This product is a non-combustible, chemically inert mineral. This mineral sample contains a small amount of naturally occurring crystalline silica as quartz. Prolonged overexposure to respirable crystalline silica may cause lung disease (silicosis). IARC, in Monograph 68, has concluded that crystalline silica inhaled in the form of quartz from occupational sources is carcinogenic to humans (Group 1); however, carcinogenicity was not detected in all industrial circumstances studied. Because applications and exposure data indicate that exposure to respirable quartz in this product with normal use is well below the OSHA Permissible Exposure Limit (PEL) and ACGIH Threshold Limit value (TLV); and because the company is not aware of any scientific or medical data available indicating that exposure to dust from this product under conditions of normal use will cause silicosis or cancer, adverse affects would not be expected from normal use of this product.

HEALTH HAZARDS

INGESTION: No adverse effects expected with unused material

INHALATION: Inhalation of excessive concentrations of dust may cause irritation of mucous membranes and upper respiratory tract.

EYE: Contact may cause mechanical irritation and possible injury.



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SKIN: No adverse effects expected.

SENSITIZATION: No adverse effects expected.

CHRONIC / CARCINOGENICITY:

Inhalation of excessive concentrations of any dust, including this material, may lead to lung injury. This product contains crystalline silica. Excessive inhalation of respirable crystalline silica may cause silicosis, a progressive, disabling and fatal disease of the lung. Symptoms may include cough, shortness of breath, wheezing and reduced pulmonary function. The international Agency for Research on Cancer (IARC), in Monograph 68 has concluded that crystalline silica inhaled in the form of quartz or cristobalite, from occupational sources, is carcinogenic to humans (Group 1). However, in making the overall evaluation, the Working Group noted that carcinogenicity was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs. The National Toxicology Program (NTP) classifies crystalline silica as reasonably anticipated to be a carcinogen. Because applications and exposure data indicate that exposure to respirable quartz in this product, with normal use, is well below the OSHA Permissible Exposure Limit (PEL) and ACGIH Threshold Limit Value (TLV); and because the company is not aware of any scientific or medical data available indicating that exposure to dust from this product under conditions of normal use will cause silicosis or cancer; adverse effects would not be expected from normal use of this product.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

None currently known

4. FIRST AID MEASURES

EYE: Immediately flush eyes with cool running water, lifting upper and lower lids. If irritation persists or foreign body in the eye, get immediate medical attention.

SKIN: None needed for normal use.

INGESTION: If used material is ingested, get medical attention due to possibility of chemical contamination. If large amount of unused material is swallowed, get immediate medical attention.

INHALATION: Remove to fresh air.

5. FIREFIGHTING MEASURES

FLASH POINT: This product is not combustible.

FLAMMABLE LIMITS: Not Applicable.

EXTINGUISHING MEDIA:

Use media that is appropriate for surrounding fire.

UNUSUAL FIRE OR EXPLOSION HAZARDS:

This product does not normally present a fire or explosion hazard, however, at concentration exceeding 0.1 oz/ft³ dusts can be ignited by sparks or other ignition sources. Minimize hazard by avoiding the generation of airborne dusts, electrically grounding equipment to prevent static



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Floor Absorbent (#1003000)

(800) 424-9300 Emergency (312) 321-1515 Information

sparks and by eliminating ignition sources in the work area. Combustion products may be hazardous.

SPECIAL FIREFIGHTING INSTRUCTIONS:

None required.

HAZARDOUS COMBUSTION PRODUCTS:

None

6. ACCIDENTAL RELEASE MEASURES

Sweep up and collect for re-use or disposal.

7. HANDLING AND STORAGE

HANDLING: Avoid breathing dust. If clothing becomes dusty, launder before re-use.

STORAGE: Store in a dry area.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE GUIDELINES:

Refer to section 2.

ENGINEERING CONTROLS:

For operations where the exposure limit may be exceeded, local exhaust ventilation is recommended.

RESPIRATORY PROTECTION:

For operations where the exposure limit may be exceeded, a NIOSH/MSHA approved high efficiency particulate respirator is recommended.

SKIN PROTECTION: None required for normal use.

EYE PROTECTION: Safety glasses or goggles recommended.

OTHER: None required for normal use.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR:

Gray to tan granules; no odor.

PHYSICAL STATE: Solid

BOILING POINT: Not applicable

VAPOR PRESSURE: Not applicable

VAPOR DENSITY: Not applicable



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Floor Absorbent (#1003000)

(800) 424-9300 Emergency (312) 321-1515 Information

SOLUBILITY IN WATER:

Insoluble

SPECIFIC GRAVITY: 2.2

pH: Not applicable

MELTING POINT: Not applicable

OCTANOL / WATER COEFFICIENT:

Not available

10. STABILITY AND REACTIVITY

STABILITY: Stable

INCOMPATIBILITY: Contact of dry clay with turpentine, vegetable oil or other unsaturated organic compounds, or with hydrofluoric acid may generate heat and/or fire. Do not use with these compounds.

HAZARDOUS DECOMPOSITION PRODUCTS:

None

HAZARDOUS POLYMERIZATION:

Will not occur.

11. TOXICOLOGICAL INFORMATION

No data available

12. ECOLOGICAL INFORMATION

No data available

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with local, state and federal environmental regulations. Unused material is suitable for disposal in sanitary landfill. Used material may be subject to regulation, depending on the nature of the material absorbed. Check with appropriate regulatory authority for used material containing hazardous waste.

14. TRANSPORTATION INFORMATION

PROPER SHIPPING NAME:

Not regulated

UN NUMBER: Not applicable

HAZARD CLASS / PACKING GROUP:

Not applicable

LABELS REQUIRED: None



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Material Safety Data Sheet

Floor Absorbent (#1003000)

(800) 424-9300 Emergency (312) 321-1515 Information

15. REGULATORY INFORMATION

CERCLA / SUPERFUND: None

SARA HAZARD CATEGORY (311/312):
Chronic Health

SARA 313: None

TSCA: All of the components of this product are listed on the EPA TSCA Inventory or exempt from notification requirements.

EINECS: All of the components of this product are listed on the EINECS Inventory or exempt from notification requirements.

EEC R&S PHRASES: Not classified as Dangerous under EEC Labeling Regulations.

JAPAN MITI: All of the components of this product are existing chemical substances as defined in the Chemical Substances Control Law.

AICS: All of the components of this product are listed on the AICS Inventory or exempt from notification requirements.

CANADIAN DSL: All of the components of this product are listed on the Canadian Domestic Substances List or exempt from notification requirements.

CA PROPOSITION 65:
This product contains respirable crystalline silica, which is known to the state of California to cause cancer.

16. OTHER INFORMATION

NFPA RATING: Health = 1, Fire = 0, Reactivity = 0

HMIS RATING: Health = 1*, Fire = 0, Reactivity = 0

The information in this data sheet is believed to be accurate. However, each purchaser should make its own test to determine the suitability of the product for its purposes. OIL-DRI CORPORATION OF AMERICA MAKES NO WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO THE PRODUCT and assumes no responsibility for any risk or liability arising from the use of the information or the product. Statements about the product should not be construed as recommendations to use the product in infringement of any patent.

**WD-40 Company****Material Safety Data Sheet****1 - Chemical Product and Company Identification**

Manufacturer: WD-40 Company	Chemical Name: Organic Mixture
Address: 1061 Cudahy Place (92110) P.O. Box 80607 San Diego, California, USA 92138-0607	Trade Name: WD-40 Aerosol
Telephone: 1-800-448-9340	Product Use: Cleaner, Lubricant, Penetrant
Emergency only: 1-888-324-7596 (PROZAR)	MSDS Date Of Preparation: 5/16/07
Information: 1-888-324-7596	

2 - Hazards Identification**Emergency Overview:**

DANGER! Harmful or fatal if swallowed. Flammable aerosol. Contents under pressure. Avoid eye contact. Use with adequate ventilation. Keep away from heat, sparks and all other sources of ignition.

Symptoms of Overexposure:

Inhalation: High concentrations may cause nasal and respiratory irritation and central nervous system effects such as headache, dizziness and nausea. Intentional abuse may be harmful or fatal.

Skin Contact: Prolonged and/or repeated contact may produce mild irritation and defatting with possible dermatitis.

Eye Contact: Contact may be mildly irritating to eyes. May cause redness and tearing.

Ingestion: This product has low oral toxicity. Swallowing may cause gastrointestinal irritation, nausea, vomiting and diarrhea. The liquid contents are an aspiration hazard. If swallowed, can enter the lungs and may cause chemical pneumonitis.

Chronic Effects: None expected.

Medical Conditions Aggravated by Exposure: Preexisting eye, skin and respiratory conditions may be aggravated by exposure.

Suspected Cancer Agent:

Yes No ☒ X

3 - Composition/Information on Ingredients

Ingredient	CAS #	Weight Percent
Aliphatic Hydrocarbon	64742-47-8	45-50
	64742-48-9	
	64742-88-7	
Petroleum Base Oil	64742-65-0	15-25
LVP Aliphatic Hydrocarbon	64742-47-8	12-18
Carbon Dioxide	124-38-9	2-3
Non-Hazardous Ingredients	Mixture	<10

4 - First Aid Measures

Ingestion (Swallowed): Aspiration Hazard. DO NOT induce vomiting. Call physician, poison control center or the WD-40 Safety Hotline at 1-888-324-7596 immediately.

Eye Contact: Flush thoroughly with water. Get medical attention if irritation persists.

Skin Contact: Wash with soap and water. If irritation develops and persists, get medical attention.

Inhalation (Breathing): If irritation is experienced, move to fresh air. Get medical attention if irritation or other symptoms develop and persist.

5 – Fire Fighting Measures

Extinguishing Media: Use water fog, dry chemical, carbon dioxide or foam. Do not use water jet or flooding amounts of water. Burning product will float on the surface and spread fire.

Special Fire Fighting Procedures: Firefighters should always wear positive pressure self-contained breathing apparatus and full protective clothing. Cool fire-exposed containers with water. Use shielding to protect against bursting containers.

Unusual Fire and Explosion Hazards: Contents under pressure. Aerosol containers may burst under fire conditions. Vapors are heavier than air and may travel along surfaces to remote ignition sources and flash back.

6 – Accidental Release Measures

Wear appropriate protective clothing (see Section 8). Eliminate all sources of ignition and ventilate area. Leaking cans should be placed in a plastic bag or open pail until the pressure has dissipated. Contain and collect liquid with an inert absorbent and place in a container for disposal. Clean spill area thoroughly. Report spills to authorities as required.

7 – Handling and Storage

Handling: Avoid contact with eyes. Avoid prolonged contact with skin. Avoid breathing vapors or aerosols. Use with adequate ventilation. Keep away from heat, sparks, hot surfaces and open flames. Wash thoroughly with soap and water after handling. Do not puncture or incinerate containers. Keep can away from electrical current or battery terminals. Electrical arcing can cause burn-through (puncture) which may result in flash fire, causing serious injury. Keep out of the reach of children.

Storage: Do not store above 120°F or in direct sunlight. U.F.C (NFPA 30B) Level 3 Aerosol.

8 – Exposure Controls/Personal Protection

Chemical	Occupational Exposure Limits
Aliphatic Hydrocarbon	100 ppm TWA (ACGIH) 1200 mg/m3 TWA (manufacturer recommended)
Petroleum Base Oil	5 mg/m3 TWA (OSHA/ACGIH)
LVP Aliphatic Hydrocarbon	1200 mg/m3 TWA (manufacturer recommended)
Carbon Dioxide	5000 ppm TWA (OSHA/ACGIH), 30,000 ppm STEL (ACGIH)
Non-Hazardous Ingredients	None Established

The Following Controls are Recommended for Normal Consumer Use of this Product

Engineering Controls: Use in a well-ventilated area.

Personal Protection:

Eye Protection: Avoid eye contact. Safety glasses or goggles recommended.

Skin Protection: Avoid prolonged skin contact. Chemical resistant gloves recommended for operations where skin contact is likely.

Respiratory Protection: None needed for normal use with adequate ventilation.

For Bulk Processing or Workplace Use the Following Controls are Recommended

Engineering Controls: Use adequate general and local exhaust ventilation to maintain exposure levels below that occupational exposure limits.

Personal Protection:

Eye Protection: Safety goggles recommended where eye contact is possible.

Skin Protection: Wear chemical resistant gloves.

Respiratory Protection: None required if ventilation is adequate. If the occupational exposure limits are exceeded, wear a NIOSH approved respirator. Respirator selection and use should be

based on contaminant type, form and concentration. Follow OSHA 1910.134, ANSI Z88.2 and good Industrial Hygiene practice.

Work/Hygiene Practices: Wash with soap and water after handling.

9 – Physical and Chemical Properties

Boiling Point:	323°F (minimum)	Specific Gravity:	0.817 @ 72°F
Solubility in Water:	Insoluble	pH:	Not Applicable
Vapor Pressure:	110 PSI @ 70°F	Vapor Density:	Greater than 1
Percent Volatile:	74%	VOC:	412 grams/liter (49.5%)
Coefficient of Water/Oil Distribution:	Not Determined	Appearance/Odor	Light amber liquid/mild odor
Flash Point:	131°F (concentrate) Tag Closed Cup	Flammable Limits: (Solvent Portion)	LEL: 1.1% UE:: 8.9%

10 – Stability and Reactivity

Stability: Stable

Hazardous Polymerization: Will not occur.

Conditions to Avoid: Avoid heat, sparks, flames and other sources of ignition. Do not puncture or incinerate containers.

Incompatibilities: Strong oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide and carbon dioxide.

11 – Toxicological Information

The oral toxicity of this product is estimated to be greater than 5,000 mg/kg based on an assessment of the ingredients. This product is not classified as toxic by established criteria. It is an aspiration hazard.

None of the components of this product is listed as a carcinogen or suspected carcinogen or is considered a reproductive hazard.

12 – Ecological Information

No data is currently available.

13 – Disposal Considerations

If this product becomes a waste, it would be expected to meet the criteria of a RCRA ignitable hazardous waste (D001). However, it is the responsibility of the generator to determine at the time of disposal the proper classification and method of disposal. Dispose in accordance with federal, state, and local regulations.

14 – Transportation Information

DOT Surface Shipping Description: Consumer Commodity, ORM-D

IMDG Shipping Description: Aerosols, 2, UN1950

15 – Regulatory Information

U.S. Federal Regulations:

CERCLA 103 Reportable Quantity: This product is not subject to CERCLA reporting requirements, however, oil spills are reportable to the National Response Center under the Clean Water Act and many states have more stringent release reporting requirements. Report spills required under federal, state and local regulations.

SARA TITLE III:

Hazard Category For Section 311/312: Acute Health, Fire Hazard, Sudden Release of Pressure

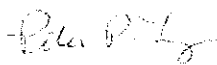
Section 313 Toxic Chemicals: This product contains the following chemicals subject to SARA Title III Section 313 Reporting requirements: None
Section 302 Extremely Hazardous Substances (TPQ): None
EPA Toxic Substances Control Act (TSCA) Status: All of the components of this product are listed on the TSCA inventory
Canadian Environmental Protection Act: All of the ingredients are listed on the Canadian Domestic Substances List or exempt from notification
Canadian WHMIS Classification: Class B-5 (Flammable Aerosol)
This MSDS has been prepared according to the criteria of the Controlled Products Regulation (CPR) and the MSDS contains all of the information required by the CPR.

16 – Other Information:

HMIS Hazard Rating:

Health -- 1 (slight hazard), Fire Hazard -- 4 (severe hazard), Reactivity -- 0 (minimal hazard)

SIGNATURE: _____



TITLE: _____

Director of Global Quality Assurance

REVISION DATE: Revision Date: May 2007

SUPERSEDES: December 2004



February 3, 2015

Mr. Thomas Mathew, P.E.
Project Manager
CDM Federal Programs
110 Fieldcrest Avenue
Edison, New Jersey 08837

**Subject: Contract Submittal Review – 2301-1.1
Old Roosevelt Field Contaminated Groundwater Area Superfund Site, Southern
Plume Plant Expansion**

Dear Mr. Mathew:

This letter presents the responses by Arrowhead Contracting to your comments on the subject submittal. Comments have been incorporated in the shop drawings as appropriate or a response has been generated as indicated in this letter.

If you have any questions or comments please contact me at (913) 814-9994.

Sincerely,

A handwritten signature in black ink that reads "Doug Ronk". The signature is written in a cursive, flowing style.

Doug Ronk
Project Manager

CDM Comment:

Original Comment B : 1.3-Submittals:

- a. Submit shop drawings per 02301-1.3.2.

Shop drawing should include the proposed trenchless work plan, the proposed means and methods, pipe specifications for the forcemain, fiber optic conduit, and the Casing Pipe (type, diameter, dimension ratio (DR), wall thickness, safe full force, critical buckling pressure, yield strength, etc.), and design calculations for the trenchless installation of forcemain and fiber optic conduit underneath Stewart Avenue and overhead high voltage electrical lines. The design calculation package should include the following; frac-out evaluation, comparison of axial tensile stresses due to pullback with allowable tensile stresses, pullback force calculation, and pipe deflection (ring deformation) calculation.

Arrowhead Response:

Refer to the attached revised drawing C-200. Please note the addition of the boring reference note. This note was added per verbal comment to address the difference between ground surface elevations and surface elevations noted on the drawings. The plan and profile reflect actual ground surface elevations.

Calculations using the pipe manufacturer's design guide are attached. These calculations provide allowable tensile stresses, pullback force, and pipe deflection calculation. A frac-out evaluation was not included as the soil report does not indicate varying soil types that would require significant variance in fluid pressure necessary to advance the boring.

New Comments:

Use one radius of curvature for the calculation. Which radius of curvature is the correct one; i.e., 500 feet that is shown on Drawing C-200 or 670 feet that is used in the calculation?

Use the correct value for the Soil Thickness (T_1) for the calculation.

Provide a frac-out evaluation.

Correct top of boring elevations, Note #1, and Note # 6 on Drawing C-200

Arrowhead Response:

Refer to the attached revised calculations for revisions of the curve radius.

Soil Thickness (T_1) in the BoreAid program refers to the upper portion of the soil profile which bears live load (i.e. traffic load) and does not refer to a soil type boundary found during installation of geotechnical borings. The live load is generally assumed to be dissipated within the uppermost 10 feet of soil.

Boring elevations have been corrected.

Please note all calculations indicate a SDR 11 pipe is adequate for this installation. Following discussion with CDM Smith Arrowhead will install SDR 9 pipe as a precautionary measure. Transmittal 15200-4 contains manufacturer's data of the proposed SDR 9 HDPE pipe

Project Old Roosevelt Field, Hemlock Directional Bore (HDB)		Item 1
Location Steward Ave Garden Cirty, LINY	Date 2/2/2015	

Installation of PE Pipe By HDD - Pull Force & Installation Stresses

INPUT VARIABLES:		Borepath Profile:	
Pipe Properties:		H - Depth of the Bore [ft]	18
Pipe Outside Diameter [in]	6.625	Pipe Entry Angle (HDD Exit Angle) [°]	14
Pipe Minimum Wall Thickness [in]	.602	Pipe Exit Angle (HDD Entry Angle) [°]	14
Standard Dimension Ratio	11	L1 - Pipe Drag on Surface [ft]	100
Specific Gravity of the Pipe Material	.96	Length of the Crossing [ft]	359
Poisson's Ratio	0.45	Backreamed Borehole Diameter [in]	12
Long-Term Apparent Modulus of Elasticity	110000	Other Data:	
24 hr - Apparent Modulus of Elasticity [psi]	123.9	Unit Weight of Water [lb/ft³]	62.40
Allowable/Safe Pull Stress[psi]	14814	Specific Gravity of the Mud Slurry	1.1
Percent of Pipe Ovality [%]	3	Coefficient of Friction at the Surface	.24
		Coefficient of Friction within Borehole	.24
		Hydrokinetic Pressure [psi]	10

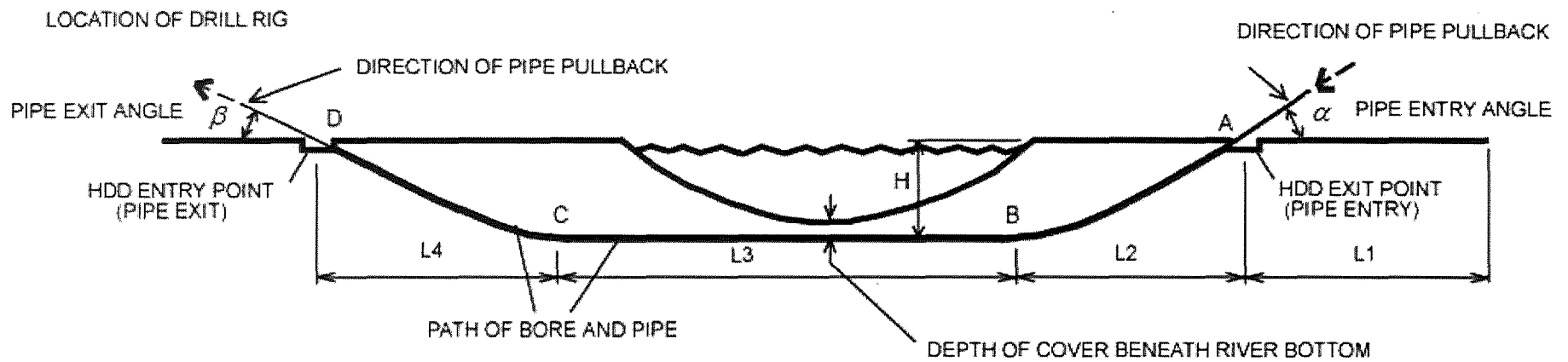
RESULTS OF CALCULATIONS:

Average Radius of Curvature for Path at Pipe Entry [ft]	603.0	Breakaway Links Settings [lbf]	168,745.
Average Radius of Curvature for Path at Pipe Exit [ft]	603.0	Static Head Pressure [psi]	3.58
L2 - Horizontal Distance to Achive Desired Depth [ft]	147.33	Maximum Pressure During Pullback	18.58
L4 - Horizontal Distance to Achive Rise to the Surface	147.33	Ovality Compensation Factor	0.77
L3 - Additional Distance Traversed at Desired Depth [ft]	64.34	Tensile Reduction Factor	1.00
Bending Strain [in/in]	0.000458	Critical Collapse Pressure [psi]	0.24
Bending Stress [psi]	0.06	Safety Factor Against Collapse	0.01
Weight of Empty Pipe [lbf/ft]	5.02		
Net Upward Buoyant Force on Empty Pipe [lbf/ft]	11.41		

Pull Force:	Check Axial Tensile Stress vs. Allowable Tensile Stress:		
	Allowable/Safe Tensile Stress [psi]	14,814.00	
Pull Force on Pipe at Point A [lbf]	586.99	Axial Tensile Stress at Point A [psi]	86.01 PASS
Pull Force on Pipe at Point B [lbf]	1,068.05	Axial Tensile Stress at Point B [psi]	128.22 PASS
Pull Force on Pipe at Point C [lbf]	1,156.93	Axial Tensile Stress at Point C [psi]	136.02 PASS
Pull Force on Pipe at Point D [lbf]	1,224.92	Axial Tensile Stress at Point D [psi]	141.99 PASS

Notes: 360' of 6" IPS HDPE SDR 11 PE 4710 Pipe

Reference: ASTM 1962 - 05, PPI Handbook



HDD Borepath Profile

Project Old Roosevelt Field, HDB		
Location Steward Ave, Garden City, LINY	Date 2/2/2015	

PE Pipe Post-Installation Loads, Deflection, and Critical Collapse

INPUT PARAMETERS:

Internal Borehole Diameter [in]	12
Depth of the Borehole below Ground Surface [ft]	18
Unit Weight of Fluid in Borehole [lb/ft³]	12.5
Unit Weight of Soil [lb/ft³]	120
Internal Friction Angle of Soil [°]	14
Pipe Outside Diameter [in]	6.625
Standard Dimension Ratio	11
Percent of Ovality	3
Apparent Modulus of Elasticity [psi]	123.9
Poisson's Ratio	0.45
Radius of Curvature [ft]	670
Live Load [lb/ft²]	120

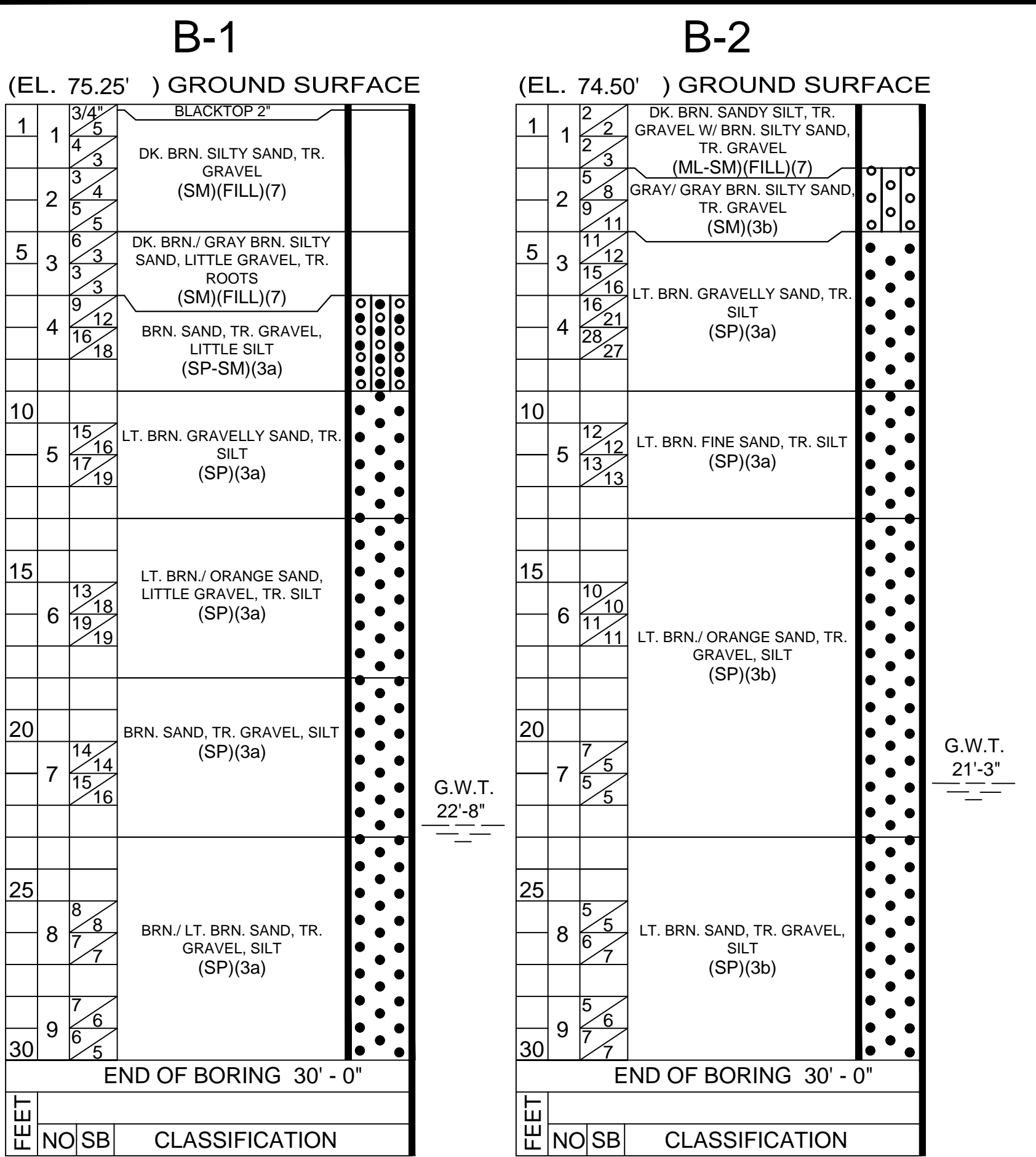
RESULTS OF CALCULATION:

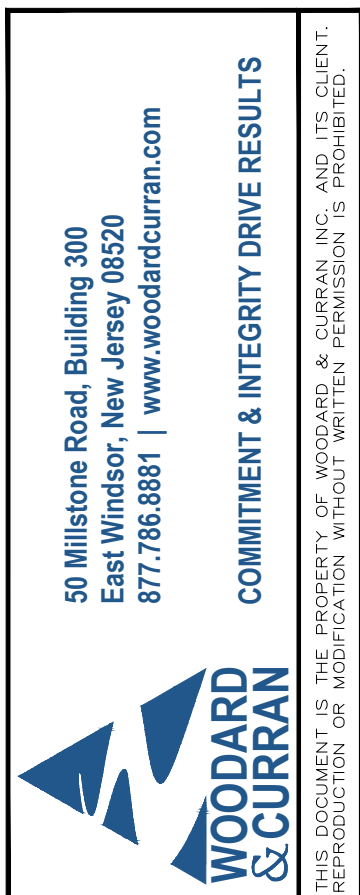
Earth Pressure Coefficient	0.61
Arching Factor	0.35
External Earth Pressure [psi]	5.19
Net External Pressure [psi]	6.02
External Pressure Deflection [%]	728.62
Buoyant Deflection [%]	0.00
Deflection due to Reissner Effect [%]	0.04
Ovality Compensation Factor [%]	0.77
Critical Collapse Pressure (No Safety Factor) [psi]	0.24
Safety Factor against Buckling	0.04

Notes: 360' of 6" HDPE SDR 11 PE 4710,
Forced Water Main

Reference: ASTM F 1962 - 05

Prepared By Leo Manzi	Approved By	Revision: 12.0.0
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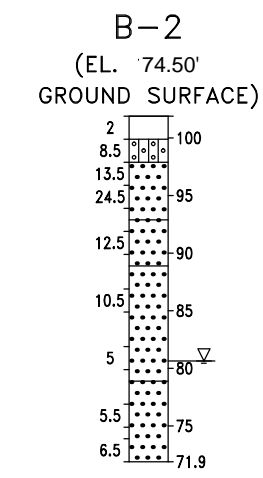




B-1
(E.L. 75.25')
GROUND SURFACE

Depth (ft)	Soil Description
0 - 14	Light gray silty clay with thin silty sand layers
14 - 16.5	Light gray silty clay
16.5 - 18.5	Light gray silty clay
18.5 - 14.5	Light gray silty clay
14.5 - 7.5	Light gray silty clay
7.5 - 6	Light gray silty clay

Water level: 73.12 ft

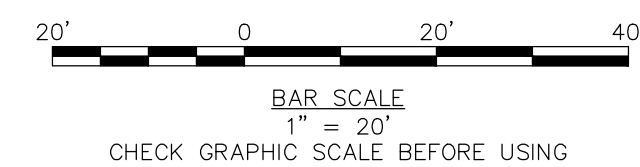


2. THESE DRAWINGS ARE FOR THE EXCLUSIVE USE OF HEMLOCK DIRECTIONAL BORE (HDB). INFORMATION ON THESE DRAWINGS WERE OBTAINED FROM HEMLOCK DIRECTIONAL BORE TO ILLUSTRATE PROPOSED MEANS AND METHODS FOR THE FORCED SEWER ACROSS STEWART AVENUE. ALL HDD CURVE DATA ARE APPROXIMATE FOR DRILLING PURPOSES.

4. SOIL MECHANICS, SEAFORD, NEW YORK 11783,
PERFORMED TWO SOIL BORINGS ON WEDNESDAY,
NOVEMBER 26, 2014. SEE DRAWING NO. 14R827-2

5. HDB SHALL BE RESPONSIBLE TO NOTIFY ONE CALL* MARK OUT (MINIMUM 3 DAYS IN ADVANCE OF CONSTRUCTION FROM DAY OF CALL IN) OF ALL SUBSURFACE UTILITIES AND WHENEVER PRACTICAL SHALL TEST HOLE/ POTHOLE TO VERIFY SUBSURFACE UTILITIES.

7.FINAL ELEVATIONS, ANGLES AND DISTANCES WILL VARY BASED ON THE FIELD CONDITIONS AND HDB FINAL ALIGNMENT AND AS BUILTS.



PROPOSED INSTALLATION OF 6" HDPE
INFLUENT PIPE BY HEMLOCK DIRECTIONAL BORING
FOR USEPA REGION 2
STEWART AVE (OLD ROOSEVELT FIELD)

HEMLOCK DIRECTIONAL DRILLING 922 NEW HARWINTON ROAD TORRINGTON, CT 06790	STEWART AVE, GARDEN CITY LONG ISLAND PROJECT BORINGS AND HDD PERMITTING PLAN
--	--

JOB NO.: 228556.01

DATE: DECEMBER 2014

SCALE: 1" = 20'

C-200

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Step 2. Borepath Design

Step 3. Calculated Results

Contact

Assumptions

Pipe Type

HDPE-PE4710

Pipe Application

M&I Pressure Pipe

Pipe Classification

Ductile Iron Pipe Size (DIPS)

Pipe Nominal Diameter



Pipe Dimension Ratio (DR)



ABOUT PPI-BORE AID

PPI-BoreAid is an online and computer desktop tool developed for and released by the Plastics Pipe Institute (PPI). These tools are developed to assist industry professionals in the evaluation of PE pipe for installation using a horizontal directional drill (HDD) by completing Handbook of PE Pipe, 2nd Edition Chapter 12 design calculations. PE pipe operation and installation calculations (deflection, unconstrained collapse, compressive wall stress, pull back force, and maximum tensile stress) are performed using a user defined bore path and soil strata. PPI-BoreAid employs the calculation methodology and framework developed in BOREAID™ - a comprehensive HDD design tool. BOREAID™ is capable of performing a full HDD design and deformation analysis using 3D surface topography, complex site stratigraphy, with full control over pipe and soil properties. It also contains as-built plots, the ability to export drill rod-by-rod plans, AutoCad import and export compatibility, a drill fluid estimator, a limiting bore pressure estimator, a project cost estimator and an equipment selector. For more information on BoreAid, visit www.boreaid.com.

PPI-BoreAid desktop computer application is a calculation tool that completes the same calculations as the online web based tool using a limited version of BOREAID™. The desktop computer tool is available, free of charge, by clicking the download button at the top of this page.

NOTE: For design information contained in Chapter 12 of the Handbook of PE Pipe, Second Edition published by the Plastic Pipe Institute (PPI) click on the hyperlinked labels.

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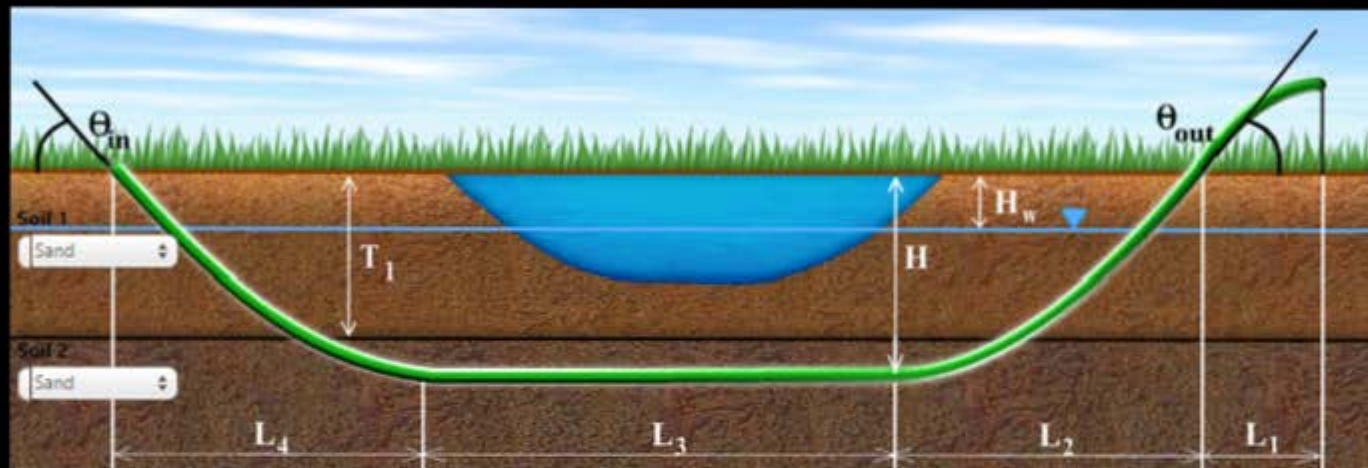
Step 1. Pipe Selection

Step 2. Borepath Design

Step 3. Calculated Results

Contact

Assumptions



Input

Calculated Values

Project Length (L, ft)	359
Pipe Entry Angle (θ_{out} , deg)	14
Pipe Exit Angle (θ_{in} , deg)	14
Depth of Cover (H, ft)	20
Depth to Water Table (H_w , ft)	22
Soil Thickness (T_1 , ft)	10
Extra Length of Pipe (L_1 , ft)	0

Length to Reach Depth of Cover (L_2 , ft)	163.7
Length Traversed at Depth (L_3 , ft)	31.6
Length to Rise From Depth of Cover (L_4 , ft)	163.7
Bending Radius at Pipe Entry (R_{in} , ft)	670.0
Bending Radius at Pipe Exit (R_{out} , ft)	670.0

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☒ Show Calculated Values
 ☐ Show Factor of Safety

*** Many design and material parameters are assumed in these calculations based upon suggested values from ASTM F1962 - Click here for a complete list of assumed parameter values.

Applied Loading:			Earth pressure = 1.5 psi. Water pressure = 0.0 psi. Mud pressure = 13.0 psi.						
HDPE-PE4710		Deflection	OPERATIONAL		INSTALLATION			Status	
DIPS Nom. OD	DIPS DR		Critical Collapse - Full - 50 yr (pressure pipe)	Critical Collapse - 1 hr	Critical Collapse - 10 hr	Pull Back Force	Allowable Pullback		
inches		% OD	psi	psi	psi	lbs	lbs		
No Rollers & No Ballast	6	9	0.2	128	285	238	2,208	19,204	PASS
	6	11	0.5	66	145	121	2,329	16,070	PASS
	6	13.5	0.9	34	74	62	2,435	13,336	PASS
With Rollers & No Ballast	6	9	0.2	128	286	239	2,208	19,204	PASS
	6	11	0.5	66	146	121	2,329	16,070	PASS
	6	13.5	0.9	34	74	62	2,435	13,336	PASS
With Rollers & Ballast	6	9	0.2	128	289	241	1,017	19,204	PASS
	6	11	0.5	66	148	123	1,011	16,070	PASS
	6	13.5	0.9	34	76	63	1,007	13,336	PASS

Red highlighted cells indicate that calculated values may be less than recommended values.

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Contact

Assumptions

*** Many design and material parameters are assumed in these calculations based upon suggested values from ASTM F1962 - Click here for a complete list of assumed parameter values.

Calculation Procedure Assumptions

- The earth pressure coefficient used in the calculations is based upon Stein's theory.
- The safe pull stress is calculated based upon minimum tensile stress requirements for PE 2406 (PE234373), PE3608 (PE345464), and PE4710 (PE445574) as outlined in ASTM D3350 - 10a Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- The operational critical collapse calculation displays the result for a water filled pipe (i.e., pressure pipe) and empty pipe (i.e., conduit, gravity-sewer).
- Operational compressive wall stress and buoyant deflection during installation are not shown.
- $\frac{3}{4}$ of the maximum calculated tensile stress is used in the installation critical collapse calculation since the maximum depth is typically not encountered past three-quarters of the bore distance.
- Entry and exit elevations are assumed equal and additional loads due to variation in topography are not considered (topography is flat).
- The silo width is assumed equal to the bore diameter for calculation of the arching factor during determination of the earth pressure.
- The 1-hr installation critical collapse pressure includes the drag pressure but the 10-hr calculation does not.
- The installation critical collapse calculations assume a pipe ovality of 3%. The operational critical collapse calculations use the larger of 3% and the earth pressure deflection.
- For bores in lithified rock, the earth pressure and deflection are not calculated but an ovality deflection of 3% is assumed for collapse calculations. The long term safety factor against collapse is calculated using a slurry unit weight of 93.57 pcf.
- These are preliminary calculations only. Qualified professionals should be contracted to consider all aspects of the design for horizontal directional drilling.

For more information contact support@ppi.boreaid.com

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**SOIL EROSION AND SEDIMENT CONTROL PLAN
REMEDIAL CONSTRUCTION ACTIVITIES
OLD ROOSEVELT FIELD CONTAMINATED GROUNDWATER AREA SUPERFUND SITE
GARDEN CITY, NEW YORK**

Submitted by:



**Arrowhead Contracting, Inc.
10981 Eicher Drive
Lenexa, Kansas 66219**

October 2014

Revision 1

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Construction Schedule
Maintenance Plan

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1-3	USDA Soil Survey Map
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	ER-2 Erosion Control Details
B	Vegetative Plan

Narrative

Project Description

This document constitutes the Soil Erosion and Sediment Control Plan for services associated with remedial construction activities at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site (ORF) located in Garden City, Nassau County, New York (site). The work involves construction of extraction well vaults, installation of groundwater conveyance piping between extraction wells and the existing groundwater treatment facility, and installation of a new electrical service connection. Installation of underground piping will involve about 2,000 linear feet of trenching. The site is located on the eastern side of Clinton Road and along the southern right of way of Stewart Avenue, approximately 0.6 mile south of the intersection with Old Country Road. The site location is shown on Figure 1-1

Site Description

The site is bounded by Clinton Road on the west, Garden City Plaza (office buildings) on the north and municipal property on the south and east. The site is generally covered in trees/brush along with maintained grass areas. Trenches will extend along the ROW of Stewart Avenue, along the edge of the Garden City athletic field, within the abandoned rail corridor and continue at the western boundary of the Garden City pumping station property to the existing groundwater treatment facility. The site is generally flat with several small piles of soil located within the area of trees and brush. The site slopes gradually toward the southeast to two stormwater recharge basins. Trenches excavated through the work area through brushy areas will require minor clearing and grubbing with no major tree removal anticipated. Work within maintained grass areas will disturb the grass, which will be restored as detailed in Appendix B.

Adjacent Property

The site is located in a commercial and residential area. The area west of Clinton Road is residential. The area north and east of the site is commercial including the Garden City Plaza office complex and the Old Roosevelt Field Mall. The area south of the site is municipal including the Garden City water tank, pumping station, and two municipal water wells. Two stormwater recharge basins are located east of the water tank area. The eastern basin, Pembroke, is located on property owned by the mall. The basin to the south is Nassau County Recharge Basin number 124. Adjacent property is shown on Figure 1-2.

Soils

The soil in the project area is the Hempstead Series or Urban Land. Urban Land consists of nearly level or gently sloping areas that are covered by buildings, roads, sidewalks, and parking lots. The Hempstead Series consists of very deep, well drained soils on outwash plains. The soils are formed in a loamy mantle overlying stratified sand and gravel. Slopes range from 0 to 3 percent. A typical soil horizon measured about one quarter mile west of the project site consists of the following:

- A horizon – 0 to 15 inches, black to dark brown silt loam, blocky structure, friable, moderate to many fine roots, moderately to strongly acid.
- B horizon – 15 to 33 inches, yellowish brown silt loam, subangular blocky structure, very friable, few fine roots, strongly acid.
- C horizon – 33 to 60 inches, very pale brown stratified sand and gravel, loose, 60 percent gravel, strongly acid.

This soil well drained with a permeability of 0.6 to 2.0 inches per hour in the topsoil and 6.0 to more than 20 inches per hour in the subsoil. The soil erodibility factor (K) ranges from 0.49 to 0.64 in the surface soil and from 0.10 to 0.20 in the subsoil. The USDA Soil Survey map for the area is shown on Figure 1-3.

Planned Erosion and Sediment Control Practices

Erosion and sediment control measures will be implemented to minimize the transport of sediment off-site and into storm water outfalls. Control measures will include a combination of the methods described below. The Site Supervisor will select the appropriate methods for erosion and sediment control consistent with conditions observed in the field, including topography, drainage features, locations of storm drains, storm water runoff patterns, and sediment content of storm water run off.

Site Preparation

Prior to opening an excavation, the area will be staked or otherwise marked (with spray paint) to indicate the anticipated trench alignment or boundary of the excavation. Excavation boundary staking/marketing will be based upon the design drawings. Trench boundaries and alignment may be adjusted in the field to avoid utilities and other obstructions. Temporary orange plastic construction fence will be erected around the work area to prevent unauthorized access. The limits of the fencing will be modified as necessary to minimize impact to the facility during construction activities. Additionally, warning signs will be posted on all sides of the work area.

Vegetation designated to remain will be protected from damage during activities by erection of suitable barriers, guards and enclosures, or by other approved methods. Site preparation will also include clearing and grubbing of vegetation within work areas and removing concrete/asphalt as necessary to allow construction.

Grassed areas will be prepared by stripping topsoil from areas to be occupied by the treatment buildings, yard piping, structures, and other areas to be excavated. Efforts will be made to not mix topsoil and subsoil during the stripping operation. Topsoil that is suitable for re-use will be stockpiled and protected until it is used during site restoration operations.

Prior to trenching in paved areas, the trench limits will be spray-painted on the pavement surface. The pavement will then be cut along straight lines using a walk-behind concrete saw. Following saw-cutting, the pavement will be broken into manageable pieces using a jack-hammer, chisel, or equivalent equipment. Alternately, the pavement may be pulverized using an excavator or back-hoe with a hydraulic hammer attachment. Concrete rubble will be collected for disposal as Construction and Demolition (C&D) debris. Asphalt rubble will be collected and recycled. Surplus topsoil, clearing and grubbing debris, and pavement debris will be disposed after all work is completed.

Erosion Checks

Baled hay or straw erosion checks will be used as a temporary means for erosion control prior to implementing silt fences and storm water inlet filters. The erosion checks will be used in areas where siltation or water runoff is determined to be a problem, such as along the toe of slopes, ditches, and storm sewer inlets. The bales shall be embedded into the ground 4 to 6 inches, where possible, to prevent water from flowing beneath them. The checks will be removed after they have served their intended purpose.

Temporary Seeding and Mulching

Temporary seeding and mulching shall be used as necessary for areas exposed for more than 14 days to prevent erosion from areas of disturbed ground in areas which were covered by vegetation prior to the commencement of work. During summer and early fall, these areas will be seeded with ryegrass (annual or perennial) at 30 pounds per acre. During winter, these areas will be seeded with winter rye (cereal rye) at 100 pounds per acre. Areas of bare soil or gravel will be restored as shown on the contract drawing.

Diversion Fences

Temporary diversion fences will not be used on this project because the low slope and high infiltration rate of the site soil make it unnecessary to divert water away from an excavation area and into a storm sewer system.

Silt Fences

Temporary silt fences will be installed downgrade of disturbed/exposed areas. The fence material shall be capable of retaining suspended silt particles found in the storm water runoff, as specified in Section 02370, Part 2.4.1 of the contract specifications. The fencing material will be cleaned every storm event or as needed.

Storm Sewer Inlet Filters

Geotextile fabric (with the properties specified in Section 02370, 2.4.1 of the subcontract specifications) shall be placed over storm sewer inlets in areas where construction is being conducted. The inlet filter material will be cleaned every storm event or as needed.

Berms

Protective soil berms will be constructed around the perimeter of open trenches. The berms will be placed in a manner that prevents storm water run-on and run-off from passing through or into the open areas.

Covers

Small piles of soil may be covered with plastic sheeting and secured in place with sandbags if it is anticipated the pile will remain in place for more than 14 days.

Informal daily inspections will be performed in active construction areas to ensure the proper performance of erosion and sediment control features. Informal weekly and as-needed inspections will be made of inactive, unvegetated, disturbed areas to ensure the protectiveness of berms, silt fences, and other control measures. Inspections will be made after each large rainfall and on a daily basis during extensive periods of rainfall.

Seeding

After construction, disturbed areas will be restored by establishing turf in accordance with Section 2900. The soil will be tested for pH, chemical analysis, and mechanical analysis and amended as necessary with lime or fertilizer to meet local growing conditions for the type and variety of turf specified. The soil will be tilled to a minimum depth of 4 inches and the appropriate seed will be applied using broadcast or drill seeding. Details are included in Appendix B – Vegetative Plan.

Grading

All filled areas shall be smoothed and graded to provide a finished surface that is reasonably smooth, compacted to the specified project requirements, free from irregular surface changes, and sloped to drain properly. Grading shall be performed to the lines and grades to match pre-existing conditions, unless otherwise shown on approved design drawings. Grading shall not create swales or areas where ponding of water will occur.

Stone and rock fragments larger than 4-inches in their greatest dimension will be removed from within the top 6-inches of the finished grade of fills and embankments. All loose or protruding rocks in slopes of cut areas will be removed to line or finish grade of the slope. All cut and fill slopes will be uniformly dressed to the slope, cross-section, and alignment shown on approved design drawings.

Dust Control

During construction operations, there is potential for nuisance dust to be generated and dispersed. The generation of dust shall be prevented when possible and controlled when necessary. Work practices shall be adjusted in a manner to minimize dust generation. During construction activities and dust level will be monitored by the SSHO using visual inspection, with the goal of zero visible dust. If dust levels cannot be maintained at the goal, Arrowhead will increase appropriate engineering and/or administrative control measures, including, but not limited to:

- Minimizing material free-fall from excavation equipment (e.g., loaders and excavators) and removing all soil from exterior surfaces of haul trucks
- Following proper decontamination protocols for equipment entering and leaving the site
- Staging trucks for loading on pavement rather than soil, to the extent possible
- Covering and securing loads on haul trucks using tarps

- Water spraying exposed soil during excavation, taking care to avoid overspraying
- Water spraying loads when transporting materials, taking care to avoid overspraying
- Water spraying piles of soil, sand, and gravel
- Covering piles of soil, sand, and gravel with plastic sheeting
- Using paved streets and roads when available
- Water spraying haul routes

Administrative controls that may be implemented include the following:

- Maintaining speed limits on roads
- Visually monitoring ambient dust levels (refer to SSHP)
- Stopping or restricting work activities when dust levels become elevated or when the wind speed is excessive

Construction Schedule

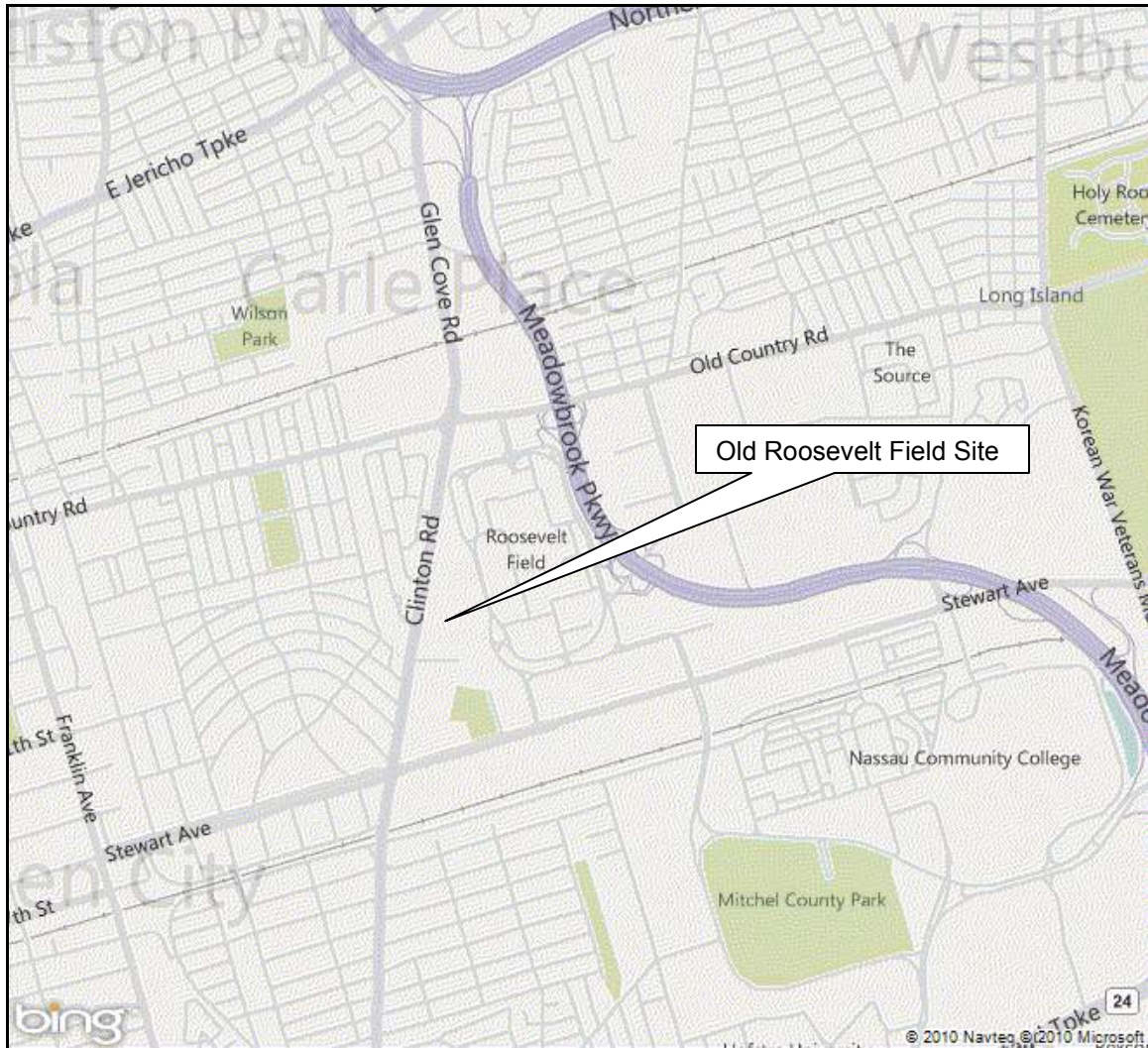
Figure 3-1 illustrates the schedule of erosion and sediment control measures in reference to the overall project tasks.

Maintenance Plan

1. All erosion and sediment control practices will be checked for stability and operation following every runoff-producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed and installed for their appropriate phase of the project.
2. All paved surfaces will be cleaned as needed to remove soil that has accumulated during construction operations.
3. Sediment will be removed from the inlet protection structures when storage capacity has been approximately 50% filled and the fabric will be cleaned/replaced when the inlet protection no longer drains properly.
4. All silt fence will be cleaned when sediment becomes approximately 6 inches deep at the fence. The silt fence will be repaired or replaced as necessary to maintain a barrier.
5. All seeded areas will be fertilized, reseeded, and mulched as necessary to maintain a vigorous, dense vegetative cover.

Appendix A

Drawings and Specifications

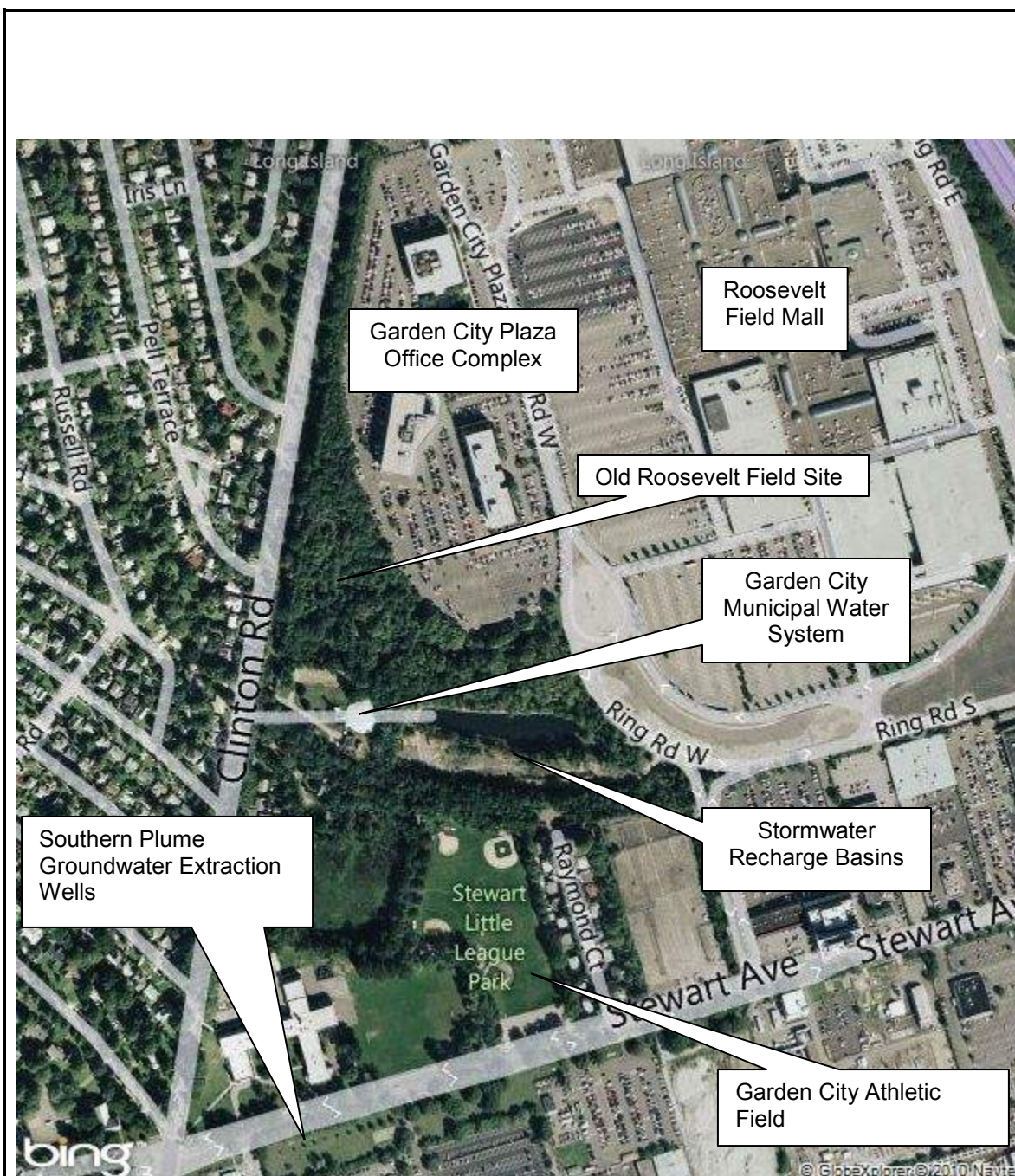


N
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Not to Scale

Figure 1-1

Old Roosevelt Field Contaminated
Groundwater Area Superfund Site
Garden City, New York

Vicinity Map



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Not to Scale

Figure 1-2

Old Roosevelt Field Contaminated
Groundwater Area Superfund Site
Garden City, New York

Adjacent Property Map



Not to Scale

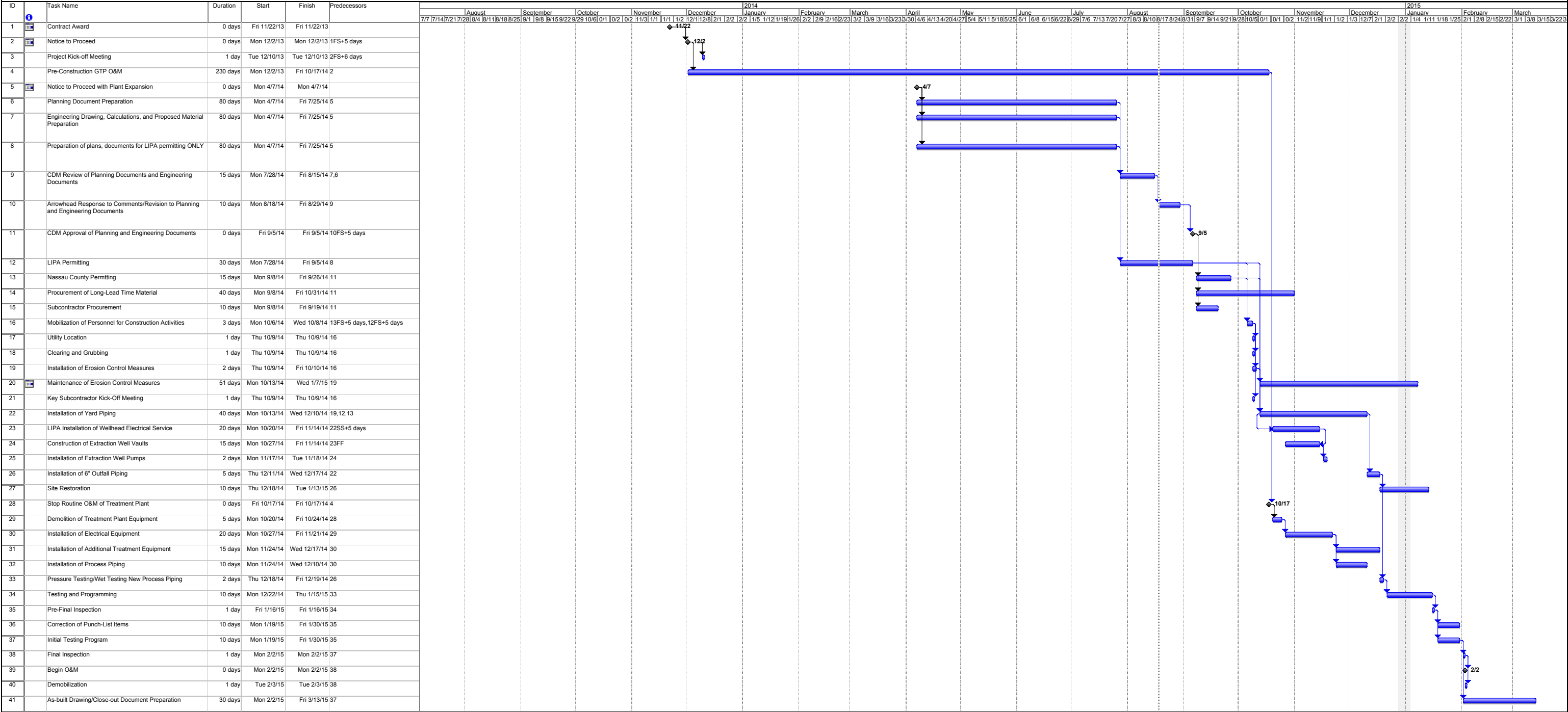
Figure 1-3

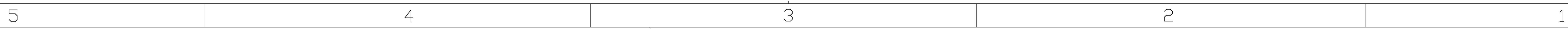
Old Roosevelt Field Contaminated
Groundwater Area Superfund Site
Garden City, New York

USDA Soil Survey Map

Figure 3-1

Old Roosevelt Field Superfund Site
Groundwater Treatment Plant Expansion
Proposed Schedule





- D

D





C

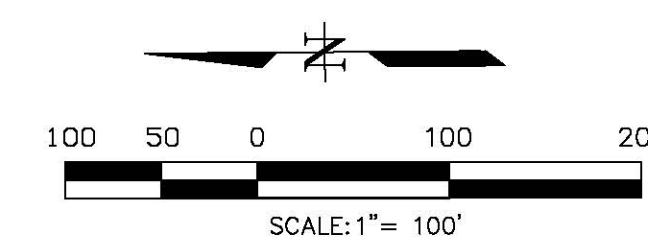
C

B


B

LEGEND:

- 
 - NORTH
 x 86.6 - EXISTING SPOT ELEVATION
 EW-1D  - PROPOSED EXTRACTION WELL LOCATION
 - SILT FENCE LOCATION
 85 - EXISTING CONTOUR LINE



TE	A
----	---

<p>VERIFY SCALE</p> <p>BAR IS ONE INCH ON ORIGINAL DRAWING</p>  <p>IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.</p>

Appendix B

Vegetative Plan

Vegetative Plan

Seedbed Preparation

Grading – backfill to finished grade as indicated on the plan drawings and place topsoil.

Unsatisfactory Environmental Conditions – preparation work will be performed only during periods when beneficial results can be obtained and not during drought, excessive moisture, or other unsatisfactory conditions.

Application of Soil Amendments – a soil test will be performed for pH, chemical analysis, and mechanical analysis to establish the type of amendments required to meet local growing conditions for the type and variety of turf specified

Fertilizer – will be applied as determined by the soil test and will be incorporated into the soil to a minimum of 4 inches or incorporated as part of the tillage.

Lime – Based on the pH test and soil type, lime will be applied at the following rate indicated in the following table.

General Lime Guidelines (at 100% effective neutralizing value ENV)

Initial Soil pH	Sand	Sandy Loam	Loam and Silt Loam	Silty Clay Loam
4.5	1.25	3.0	4.75	6.2
4.6-4.7	1.25	3.0	4.5	6.25
4.8-4.9	1.25	2.75	4.25	6.0
5.0-5.1	1.0	2.5	3.75	5.25
5.2-5.3	0.75	2.0	3.25	4.25
5.4-5.5	0.5	1.5	2.0	3.0
5.6-5.7	0.5	1.0	1.5	2.25
5.8-5.9	0.35	0.75	1.25	1.75
6.0-6.1	0.3	0.75	1.0	1.5
6.2-6.3	0.2	0.5	0.75	1.0
6.4-6.5	0.15	0.35	0.5	0.75
6.6-6.7	0.1	0.25	0.35	0.5

The above lime guidelines are in ton per acre and are based on a plow depth of 4 inches. Reference per page 3.1 of the New York Standard and Specifications for Erosion and Sediment Control.

Tillage – to a depth of 4 inches using plowing, disking, harrowing, rototilling or other similar method.

Finished Grading – New surfaces will be graded to 1 inch below the adjoining grade of any surfaced area. New surfaces will be blended to existing areas. The surface will be free of debris

and stones larger than 1 inch. Finished graded areas will be protected from damage by vehicular or pedestrian traffic and from erosion.

Seed Mixtures

Temporary Seed Mixtures – If temporary seeding is necessary to provide cover when permanent seedings are likely to fail due to mid-summer heat or drought, temporary seed species will be as specified by NYSDEC according to season of installation.

Permanent Seed Mixtures – NYSDEC general purpose seed mix (Mix #6), as described in the following table.

Variety	Common Name	Planting Rate (lbs/acre)
Ensylva, Pennlawn, Boreal	Creeping Red Fescue	60
KY-31/Rebel	Tall Fescue	60
Pennfine, Linn	Perennial Ryegrass	15
Empire, Pardee	Birdsfoot Trefoil	30

Seeding Method – do not broadcast seed when the wind velocity is such as to prevent uniform seed distribution.

Applying Seed – apply the seed uniformly at a rate of 3 lbs per 1,000 square feet using a broadcast seeder. Half the seed should be broadcast in one direction and the remainder at right angles to the first direction. Seed will be covered an average depth of ¼ inch by disk harrow, steel mat drag, cultipacker, or other similar device.

Seeding Time – Seed will be sown from March 1 to May 15 or from August 15 to October 1.

Mulch – straw mulch will be applied at a rate of 90 lbs per 1,000 square feet and will be anchored appropriately.

Hay Mulch – cured hay, free of primary noxious weed seeds and rough or woody materials.

Straw Mulch – oat, wheat, rye, barley, or rice stalks free of weeds, mold, and other deleterious material.

Maintenance – will include eradicating weeds, protecting embankments and ditches from erosion, maintaining erosion control materials, and protecting turfed areas from traffic.

Protection of Turfed Areas – immediately after seeding, the area will be protected against traffic or other use by erecting barricades and providing signage as required.

Repair - Turf areas will be reestablished for eroded, damaged, or barren areas.

Mowing - Turfed areas will be mowed to a height of 3 inches when the height of the turf becomes 5 inches. Clippings will be removed when the amount of cut turf is heavy enough to damage the turfed areas.

Watering - will be at intervals to obtain a moist soil condition to a minimum depth of 2 inches. Frequency of watering and quantity of water will be adjusted in accordance with the growth of the turf.

Turf Establishment Period – will be a minimum of 12 weeks after the last day of turfing operations, pending final inspection.